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(54) ELECTRONIC DEVICE FOR CONTROLLING SOURCE DRIVING OF PIXEL ON BASIS OF CHARACTERISTICS OF IMAGE, AND IMAGE OUTPUT METHOD USING ELECTRONIC DEVICE

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(52) **U.S. Cl.**
CPC ***G09G 3/2003*** (2013.01); *G09G 2310/027* (2013.01); *G09G 2310/0291* (2013.01); *G09G 2330/021* (2013.01)

(58) **Field of Classification Search**
CPC G09G 3/2003; G09G 2310/027; G09G 2310/0291; G09G 2330/021; G09G 3/20
See application file for complete search history.

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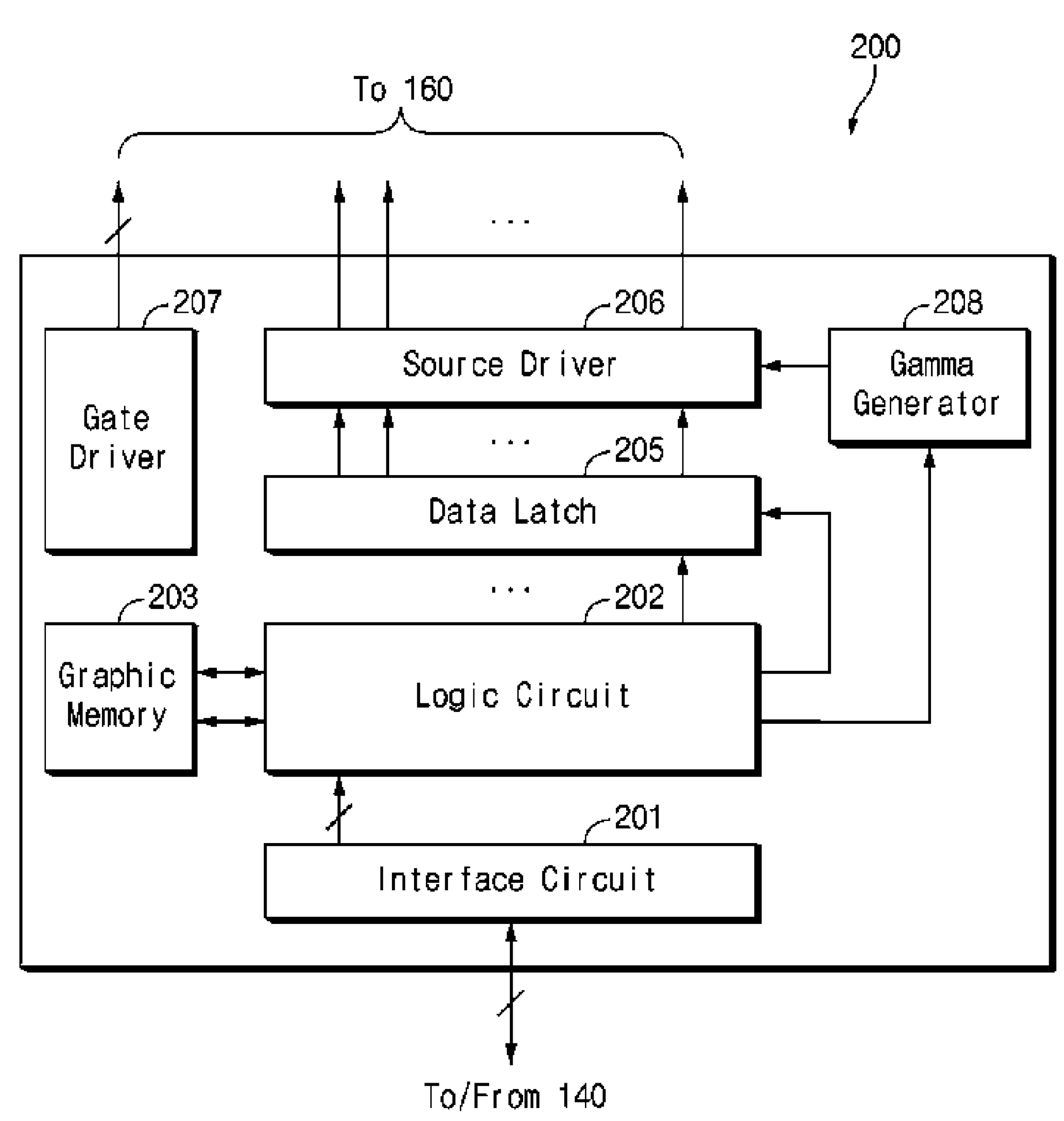
Primary Examiner — Grant Sitta

(57) **ABSTRACT**

An electronic device according to various embodiments of the disclosure includes a processor, a display panel that includes a plurality of pixels (the plurality of pixels include a first pixel and a second pixel), and a display driving circuit that drives the display panel and receives image data to be displayed through the display panel from the processor, and the display driving circuit is composed to identify output data of the first pixel and output data of the second pixel to display the image data, and, when the output data of the first pixel and the output data of the second pixel have more than
(Continued)



a specified similarity, is composed to drive the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

13 Claims, 12 Drawing Sheets

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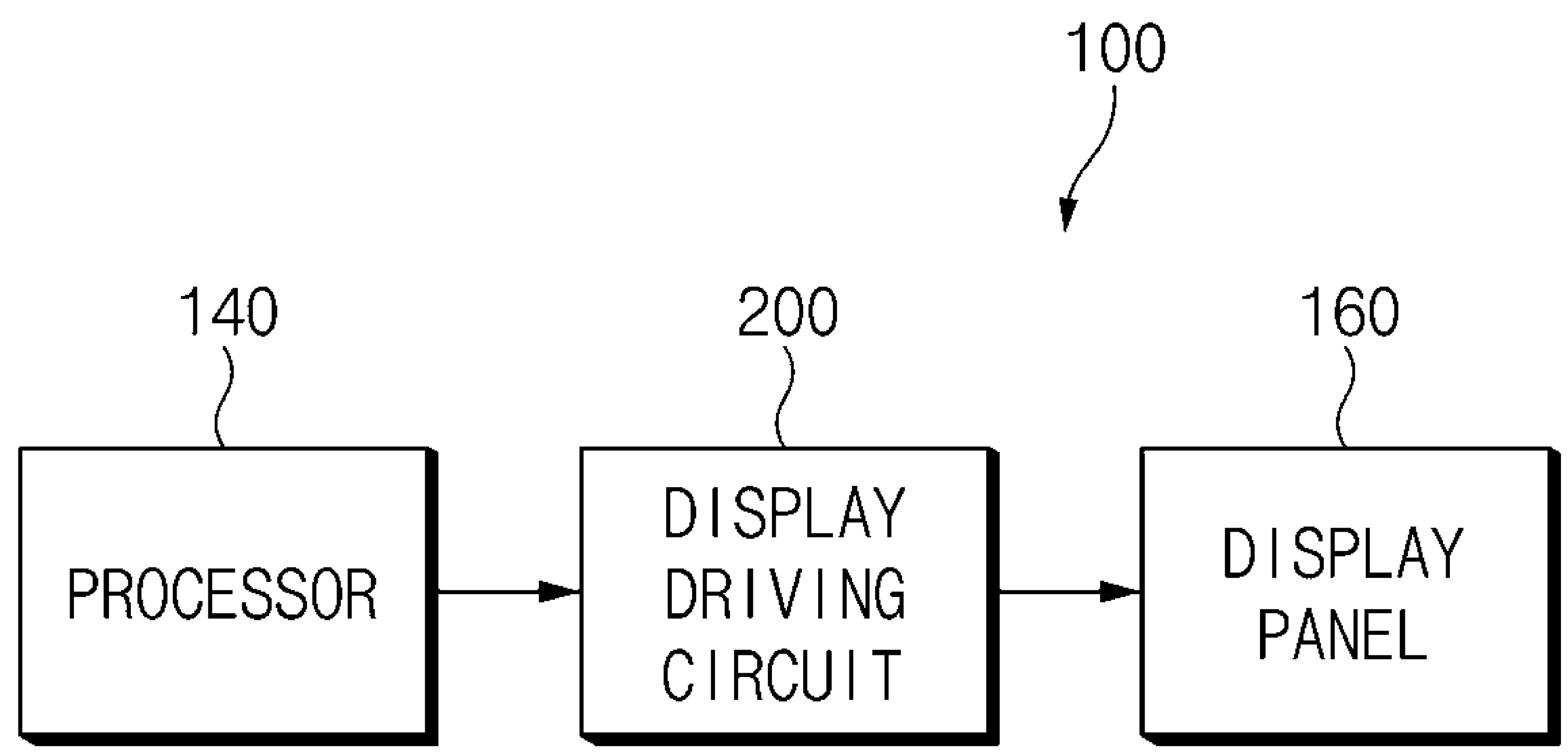
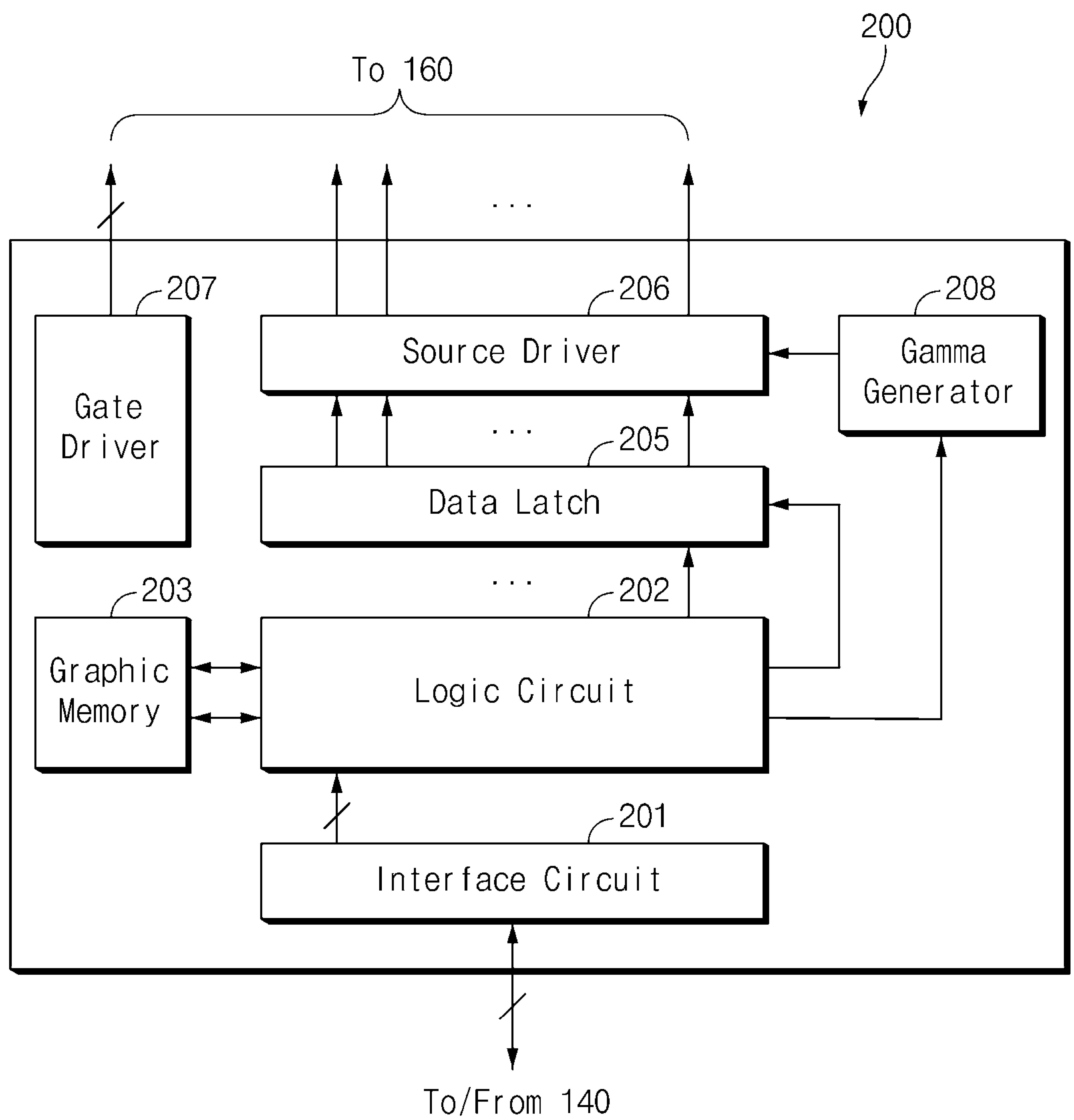

100
140
200
160
PROCESSOR
DISPLAY
DRIVING
CIRCUIT
DISPLAY
PANEL

FIG.1



200
To 160
207
Gate Driver
206
Source Driver
208
Gamma Generator
205
Data Latch
203
Graphic Memory
202
Logic Circuit
201
Interface Circuit
To/From 140

FIG.2

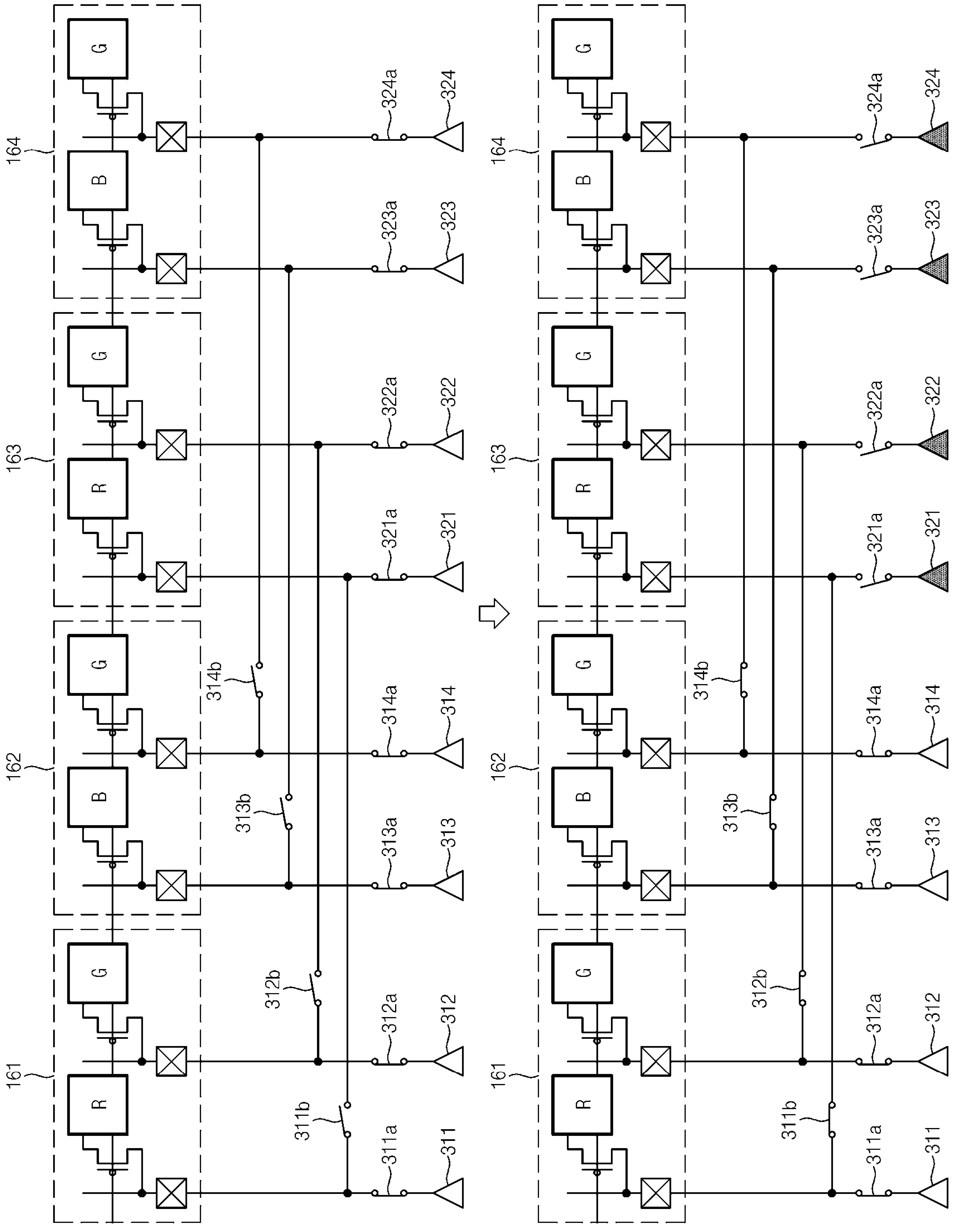

161
162
163
164
R
G
B
311
312
313
314
321
322
323
324
311a
312a
313a
314a
321a
322a
323a
324a
311b
312b
313b
314b

FIG.3A

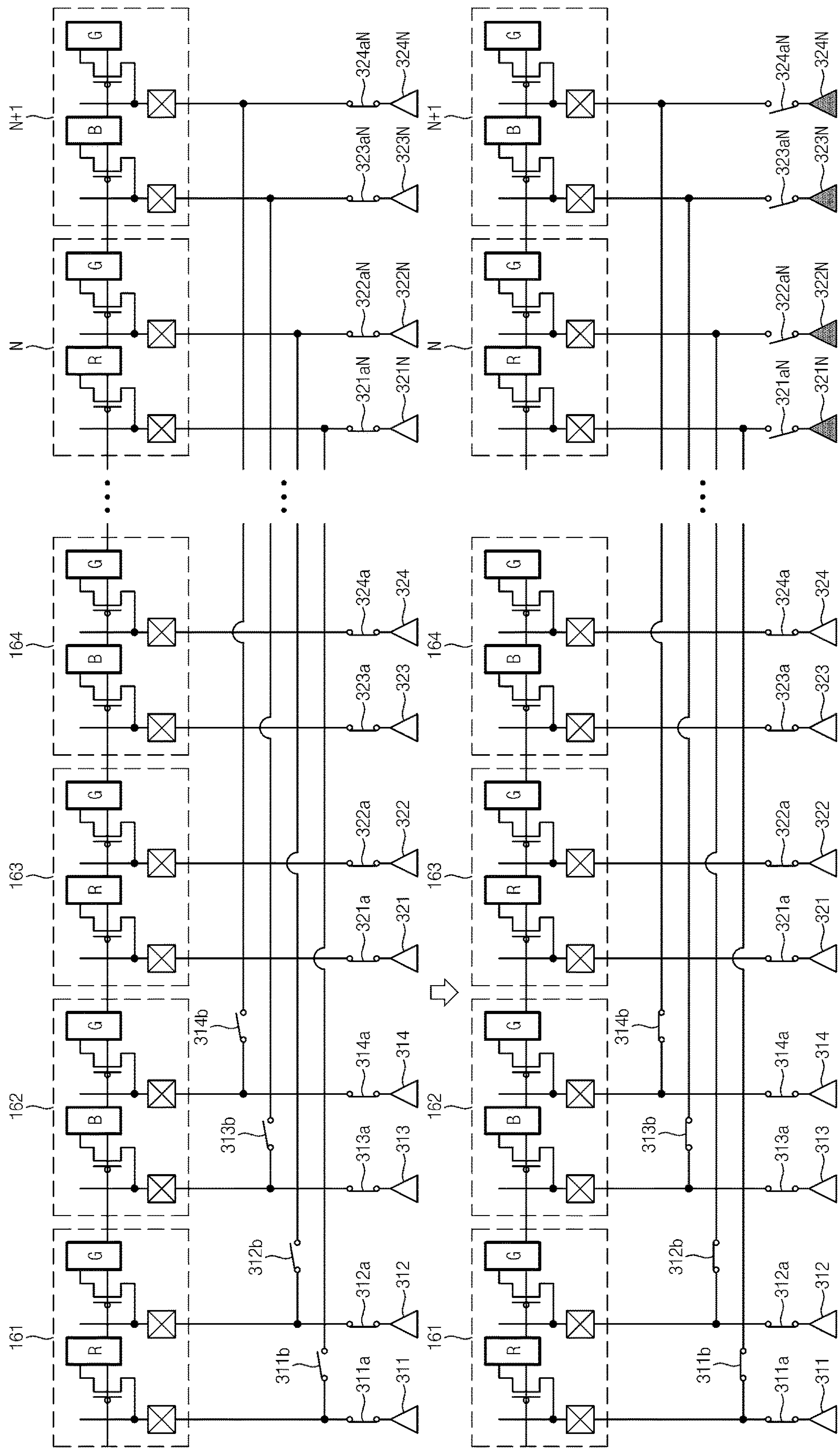

161
162
163
164
N
N+1
R
G
B
311
311a
311b
312
312a
312b
313
313a
313b
314
314a
314b
321
321a
322
322a
323
323a
324
324a
321N
321aN
322N
322aN
323N
323aN
324N
324aN

FIG.3B

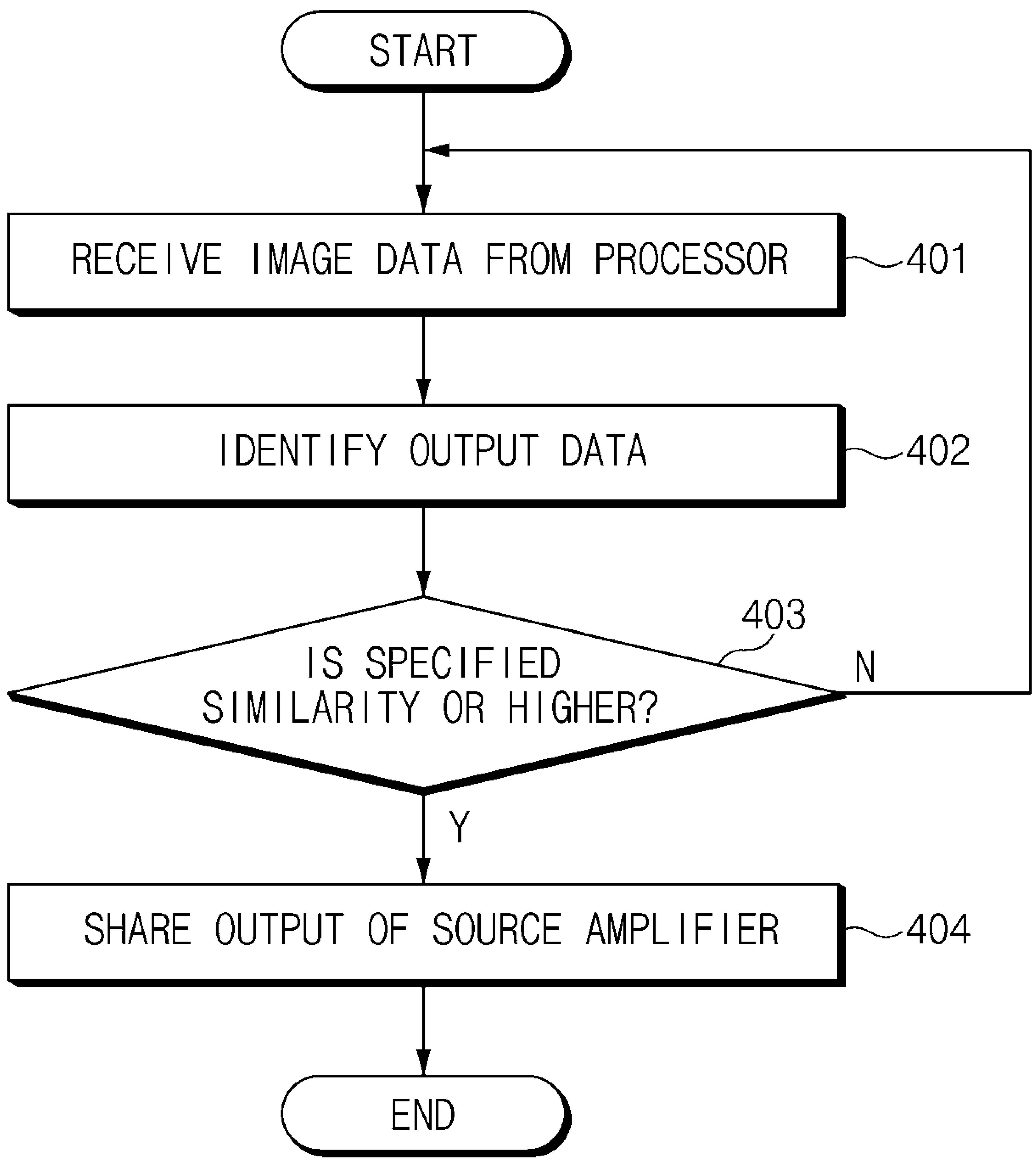

START
RECEIVE IMAGE DATA FROM PROCESSOR
401
IDENTIFY OUTPUT DATA
402
403
IS SPECIFIED SIMILARITY OR HIGHER?
N
Y
SHARE OUTPUT OF SOURCE AMPLIFIER
404
END

FIG.4A

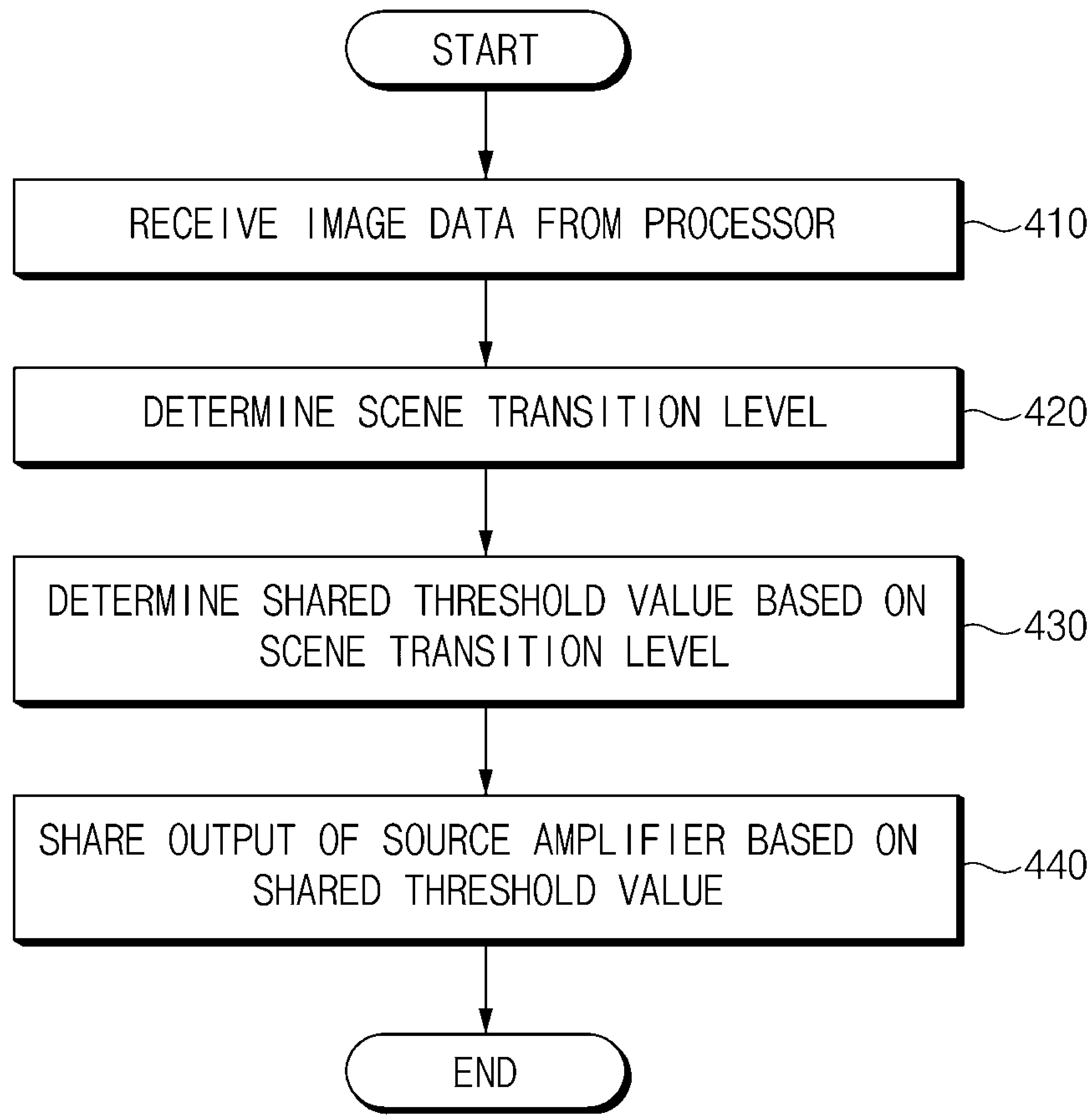
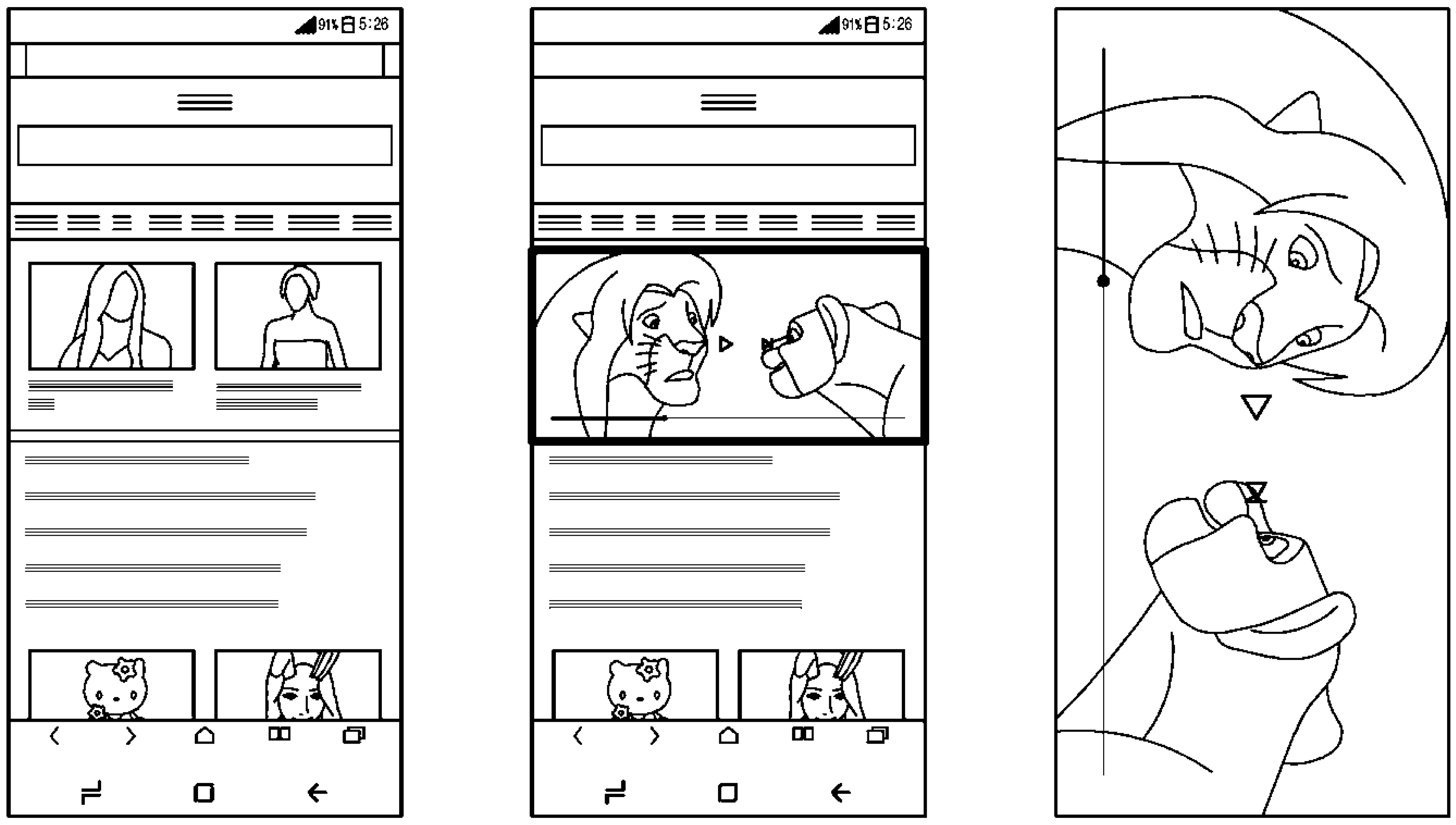
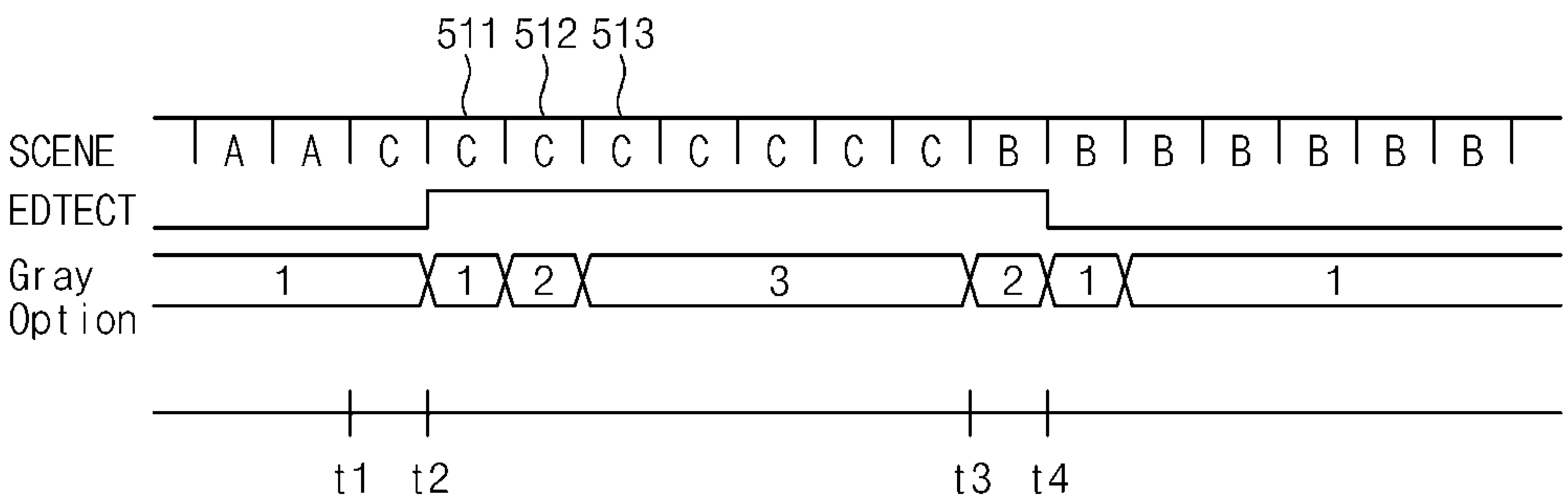

START
RECEIVE IMAGE DATA FROM PROCESSOR
410
DETERMINE SCENE TRANSITION LEVEL
420
DETERMINE SHARED THRESHOLD VALUE BASED ON SCENE TRANSITION LEVEL
430
SHARE OUTPUT OF SOURCE AMPLIFIER BASED ON SHARED THRESHOLD VALUE
440
END

FIG.4B





511 512 513
SCENE
A A C C C C C C C C B B B B B B B
EDTECT
Gray Option
1 1 2 3 2 1 1
t1 t2 t3 t4

FIG.5

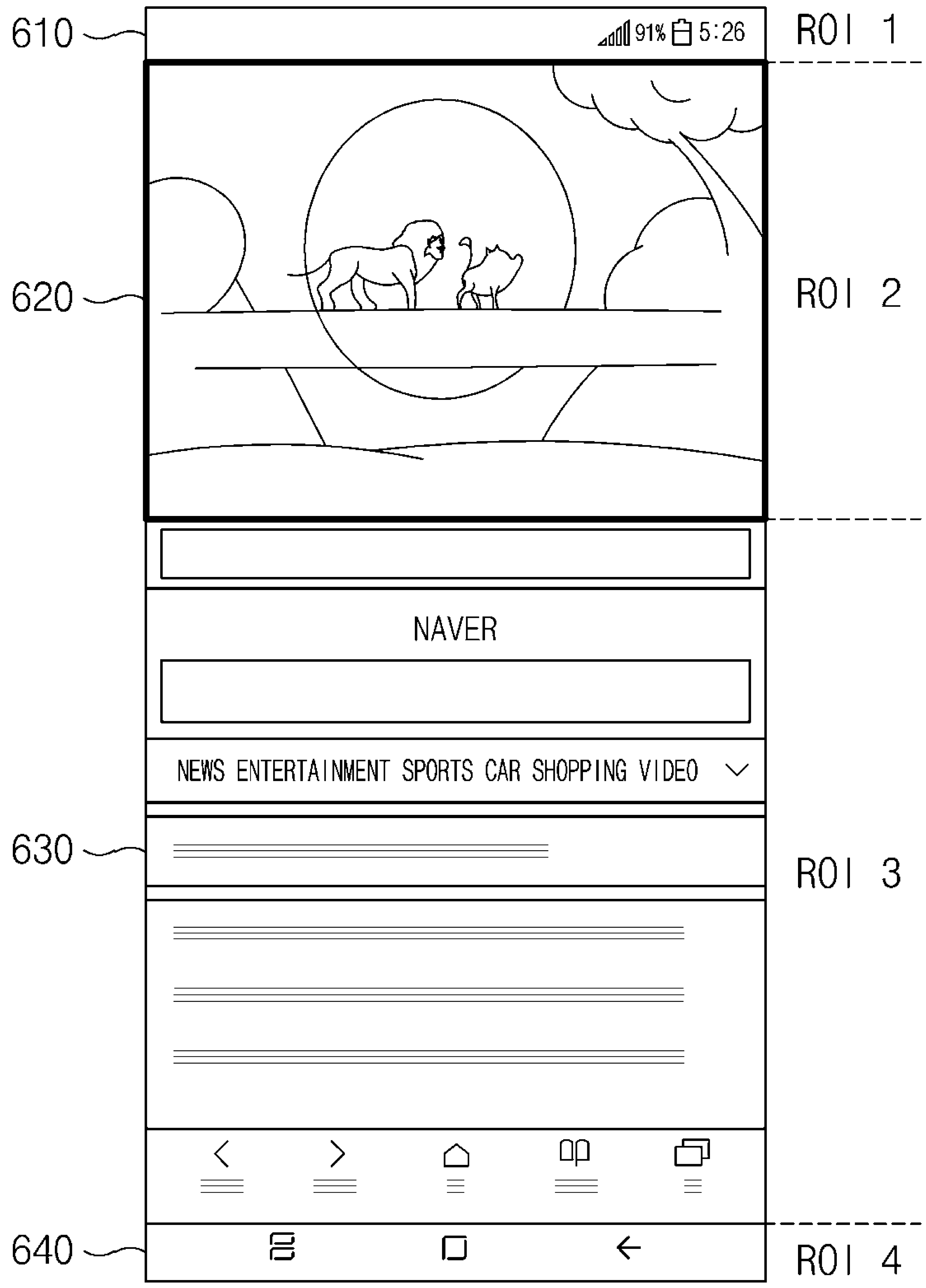
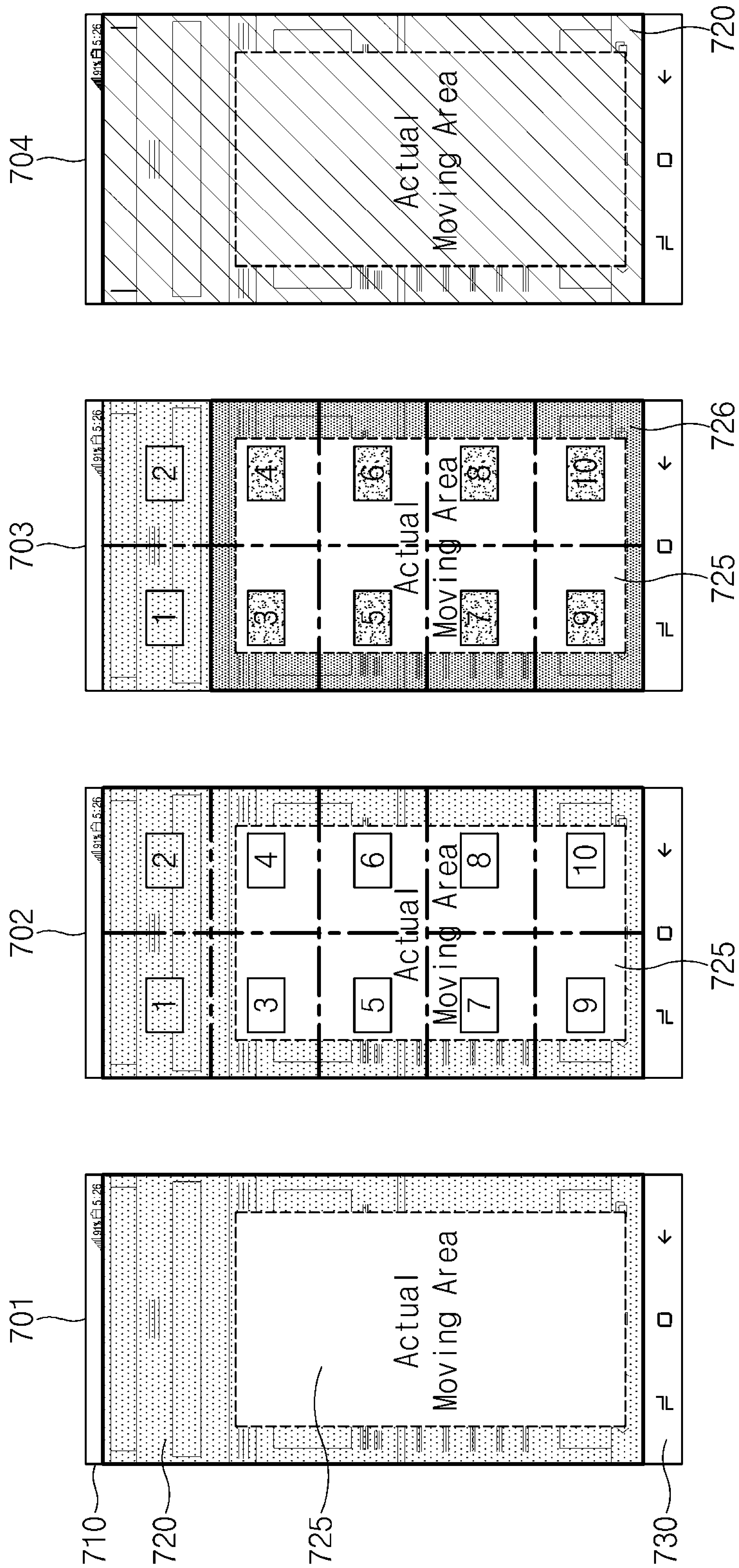

610
620
630
640
ROI 1
ROI 2
ROI 3
ROI 4
91% 5:26
NAVER
NEWS ENTERTAINMENT SPORTS CAR SHOPPING VIDEO

FIG.6



704
720
Actual Moving Area
703
726
725
1
2
3
4
5
6
7
8
9
10
702
701
710
730

FIG.7

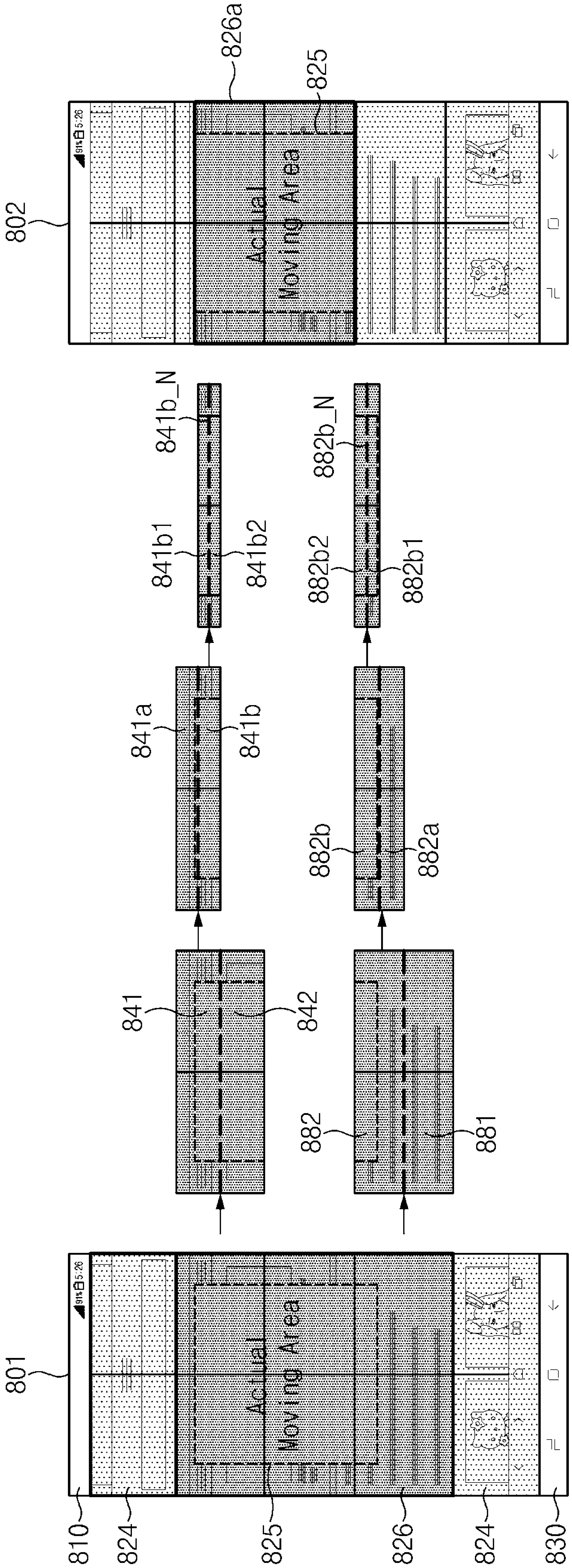

801
802
810
824
825
826
830
826a
841
842
881
882
841a
841b
882a
882b
841b1
841b2
841b_N
882b1
882b2
882b_N
Actual Moving Area

FIG. 8

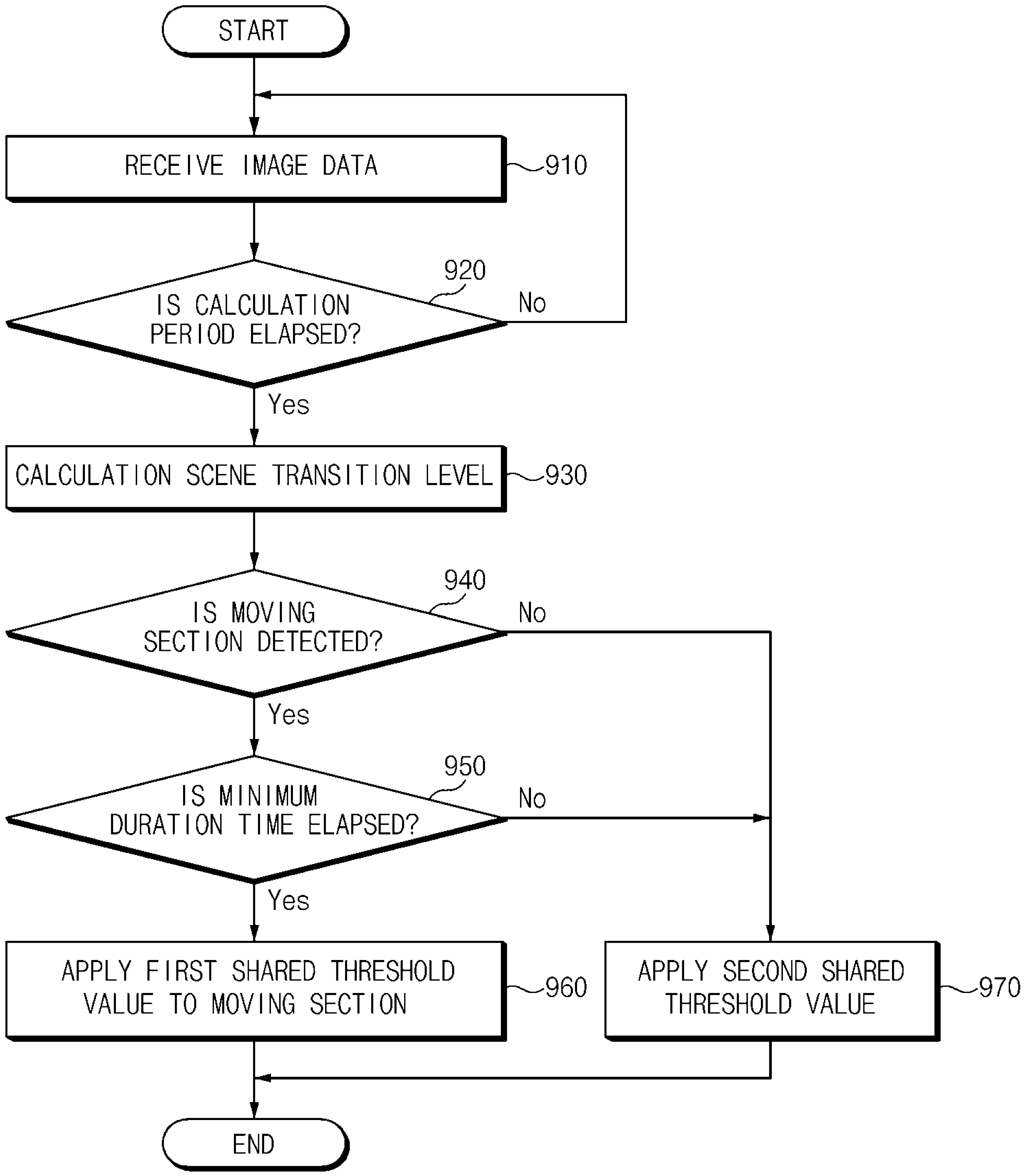

START
RECEIVE IMAGE DATA
910
920
IS CALCULATION PERIOD ELAPSED?
No
Yes
CALCULATION SCENE TRANSITION LEVEL
930
940
IS MOVING SECTION DETECTED?
No
Yes
950
IS MINIMUM DURATION TIME ELAPSED?
No
Yes
APPLY FIRST SHARED THRESHOLD VALUE TO MOVING SECTION
960
APPLY SECOND SHARED THRESHOLD VALUE
970
END

FIG.9

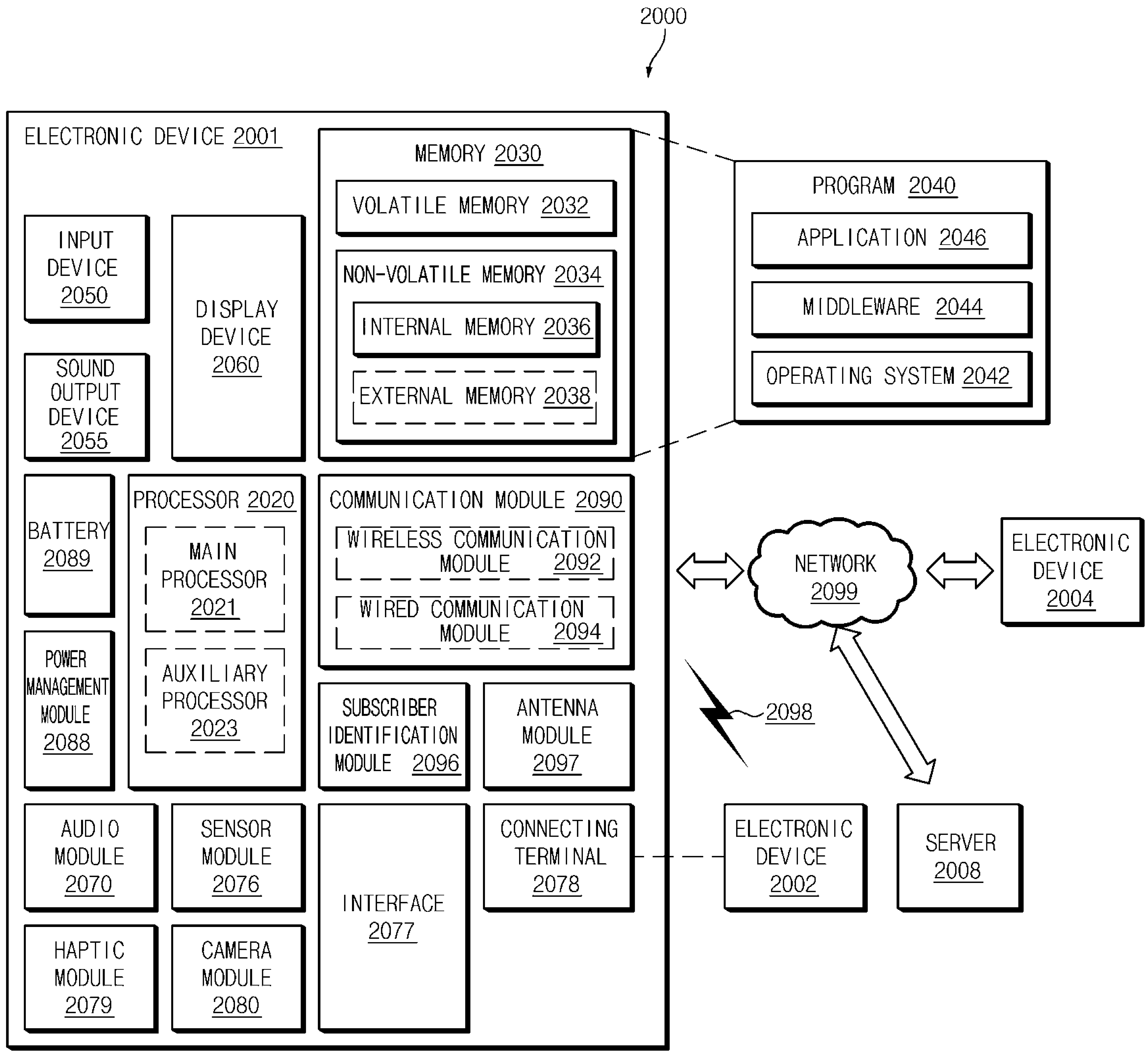

2000
ELECTRONIC DEVICE 2001
INPUT DEVICE 2050
DISPLAY DEVICE 2060
MEMORY 2030
VOLATILE MEMORY 2032
NON-VOLATILE MEMORY 2034
INTERNAL MEMORY 2036
EXTERNAL MEMORY 2038
PROGRAM 2040
APPLICATION 2046
MIDDLEWARE 2044
OPERATING SYSTEM 2042
SOUND OUTPUT DEVICE 2055
BATTERY 2089
PROCESSOR 2020
MAIN PROCESSOR 2021
AUXILIARY PROCESSOR 2023
POWER MANAGEMENT MODULE 2088
COMMUNICATION MODULE 2090
WIRELESS COMMUNICATION MODULE 2092
WIRED COMMUNICATION MODULE 2094
NETWORK 2099
ELECTRONIC DEVICE 2004
SUBSCRIBER IDENTIFICATION MODULE 2096
ANTENNA MODULE 2097
2098
AUDIO MODULE 2070
SENSOR MODULE 2076
INTERFACE 2077
CONNECTING TERMINAL 2078
ELECTRONIC DEVICE 2002
SERVER 2008
HAPTIC MODULE 2079
CAMERA MODULE 2080

FIG.10

ELECTRONIC DEVICE FOR CONTROLLING SOURCE DRIVING OF PIXEL ON BASIS OF CHARACTERISTICS OF IMAGE, AND IMAGE OUTPUT METHOD USING ELECTRONIC DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a 371 National Stage of International Application No. PCT/KR2018/016308, filed Dec. 20, 2018, which claims priority to Korean Patent Application No. 10-2017-0176564, filed Dec. 20, 2017, the disclosures of which are herein incorporated by reference in their entirety.

BACKGROUND

1. Field

Various embodiments of the disclosure relate to an electronic device including a display and an image output method.

2. Description of Related Art

An electronic device such as smart phones and tablet PCs may output various contents through a display. The electronic device may execute an application and may display an execution screen of the application on the display. For example, the electronic device may execute a browser application to provide various search screens.

The electronic device may operate by power provided from a charged battery. A power consumption of the display may occupy a large portion of total power consumption of the electronic device.

SUMMARY

The electronic device according to the related art supplies a signal through a source amplifier for each pixel by a display driver integrated circuit (DDI) that drives a display panel. Since the electronic device supplies power signals to pixels having the same or similar image data as pixels adjacent to one another, there is a problem in that the power consumed by the display panel increases.

An electronic device according to various embodiments of the disclosure includes a processor, a display panel that includes a plurality of pixels (the plurality of pixels include a first pixel and a second pixel), and a display driving circuit that drives the display panel and receives image data to be displayed through the display panel from the processor, and the display driving circuit may be composed to identify output data of the first pixel and output data of the second pixel to display the image data, and, when the output data of the first pixel and the output data of the second pixel have more than a specified similarity, may be composed to drive the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

An electronic device and an image output method according to various embodiments of the disclosure may reduce a power consumption in a display panel by limiting an output of some amplifiers when output values of adjacent pixels are the same or similar.

An electronic device and an image output method according to various embodiments of the disclosure may be used to share a source amplifier between adjacent pixels by detecting a moving level of an image in an output display.

An electronic device and an image output method according to various embodiments of the disclosure may reduce a level difference on a screen that may be viewed by the user depending on sharing of a source amplifier between adjacent pixels.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram schematically illustrating a configuration of an electronic device including a display driving circuit according to various embodiments.

FIG. **2** is a diagram illustrating a display driving circuit according to various embodiments.

FIG. **3**A is a diagram illustrating an example of some components of an electronic device including a pentile display panel according to various embodiments.

FIG. **3**B illustrates sharing of a source amplifier among pixels within a specified distance according to various embodiments.

FIG. **4**A is a flowchart illustrating an image output method according to various embodiments.

FIG. **4**B is a flowchart illustrating an image output method according to various embodiments.

FIG. **5** illustrates a change of a shared threshold value depending on a scene transition according to various embodiments.

FIG. **6** is an exemplary view of a screen sharing a source amplifier by dividing a display panel into a plurality of sections, according to various embodiments.

FIG. **7** is an exemplary view of a screen detecting a moving section according to various embodiments.

FIG. **8** is an exemplary view of a screen determining a moving section in a dynamic manner according to various embodiments.

FIG. **9** is a flowchart illustrating a method of sharing a source amplifier depending on various conditions according to various embodiments.

FIG. **10** is a block diagram of an electronic device in a network environment, for controlling a source driving of a pixel, based on characteristics of an image, according to various embodiments.

DETAILED DESCRIPTION

Hereinafter, various embodiments of the disclosure may be described with reference to accompanying drawings. Accordingly, those of ordinary skill in the art will recognize that modifications, equivalents, and/or alternatives on the various embodiments described herein can be variously made without departing from the scope and spirit of the disclosure. With regard to description of drawings, similar components may be marked by similar reference numerals.

In the disclosure, the expressions "have", "may have", "include" and "comprise", or "may include" and "may comprise" used herein indicate existence of corresponding features (e.g., components such as numeric values, functions, operations, or parts) but do not exclude presence of additional features.

In the disclosure, the expressions "A or B", "at least one of A or/and B", or "one or more of A or/and B", and the like may include any and all combinations of one or more of the associated listed items. For example, the term "A or B", "at least one of A and B", or "at least one of A or B" may refer to all of the case (1) where at least one A is included, the case (2) where at least one B is included, or the case (3) where both of at least one A and at least one B are included.

The terms, such as "first", "second", and the like used in the disclosure may be used to refer to various components regardless of the order and/or the priority and to distinguish the relevant components from other components, but do not limit the components. For example, "a first user device" and "a second user device" indicate different user devices regardless of the order or priority. For example, without departing the scope of the disclosure, a first component may be referred to as a second component, and similarly, a second component may be referred to as a first component.

It will be understood that when a component (e.g., a first component) is referred to as being "(operatively or communicatively) coupled with/to" or "connected to" another component (e.g., a second component), it may be directly coupled with/to or connected to the other component or an intervening component (e.g., a third component) may be present. In contrast, when a component (e.g., a first component) is referred to as being "directly coupled with/to" or "directly connected to" another component (e.g., a second component), it should be understood that there are no intervening component (e.g., a third component).

According to the situation, the expression "configured to" used in the disclosure may be used as, for example, the expression "suitable for", "having the capacity to", "designed to", "adapted to", "made to", or "capable of". The term "configured to" must not mean only "specifically designed to" in hardware. Instead, the expression "a device configured to" may mean that the device is "capable of" operating together with another device or other parts. For example, a "processor configured to (or set to) perform A, B, and C" may mean a dedicated processor (e.g., an embedded processor) for performing a corresponding operation or a generic-purpose processor (e.g., a central processing unit (CPU) or an application processor) which performs corresponding operations by executing one or more software programs which are stored in a memory device.

Terms used in the disclosure are used to describe specified embodiments and are not intended to limit the scope of the disclosure. The terms of a singular form may include plural forms unless otherwise specified. All the terms used herein, which include technical or scientific terms, may have the same meaning that is generally understood by a person skilled in the art. It will be further understood that terms, which are defined in a dictionary and commonly used, should also be interpreted as is customary in the relevant related art and not in an idealized or overly formal unless expressly so defined in various embodiments of the disclosure. In some cases, even if terms are terms which are defined in the disclosure, they may not be interpreted to exclude embodiments of the disclosure.

An electronic device according to various embodiments of the disclosure may include at least one of, for example, smartphones, tablet personal computers (PCs), mobile phones, video telephones, electronic book readers, desktop PCs, laptop PCs, netbook computers, workstations, servers, personal digital assistants (PDAs), portable multimedia players (PMPs), Motion Picture Experts Group (MPEG-1 or MPEG-2) Audio Layer 3 (MP3) players, mobile medical devices, cameras, or wearable devices. According to various embodiments, the wearable device may include at least one of an accessory type (e.g., watches, rings, bracelets, anklets, necklaces, glasses, contact lens, or head-mounted-devices (HMDs)), a fabric or garment-integrated type (e.g., an electronic apparel), a body-attached type (e.g., a skin pad or tattoos), or a bio-implantable type (e.g., an implantable circuit).

Hereinafter, electronic devices according to various embodiments will be described with reference to the accompanying drawings. In the disclosure, the term "user" may refer to a person who uses an electronic device or may refer to a device (e.g., an artificial intelligence electronic device) that uses the electronic device.

FIG. **1** is a diagram schematically illustrating a configuration of an electronic device including a display driving circuit according to various embodiments.

Referring to FIG. **1**, an electronic device **100** may include a processor (e.g., an application processor (AP)) **140**, a display driver IC (DDI) **200**, and a display panel **160**. The electronic device **100** may be implemented as, for example, a portable electronic device. According to various embodiments, the display driving circuit **200** and the display panel **160** may be implemented as separate (or external) display devices (or display modules) excluding the processor **140**.

The processor **140** may control an overall operation of the electronic device **100**. According to one embodiment, the processor **140** may be implemented as an integrated circuit, a system on a chip, or a mobile AP. The processor **140** may transmit data (e.g., image data, video data, or still image data) to be displayed to the display driving circuit **200**. According to an embodiment, the data may be divided in units of line data corresponding to a horizontal line (or vertical line) of the display panel **160**.

The display driving circuit **200** may change the image data transmitted from the processor **140** into a form that can be transmitted to the display panel **160**, and may transmit the changed image data to the display panel **160**. The changed image data (hereinafter, output data) may be supplied in units of pixels. In this case, a pixel is a structure in which sub-pixels Red, Green, and Blue are adjacently arranged in associated with a specified color display, and one pixel may include an RGB sub-pixel (RGB stripe layout structure) or RGGB sub-pixels (pentile layout structure). In this case, the layout structure of the RGGB sub-pixels may be replaced with the layout structure of the RGBG sub-pixels. Alternatively, the pixel may be replaced with an RGBW sub-pixel layout structure.

According to one embodiment, the display driving circuit **200**, when the output data between adjacent pixels has a difference within a specified range, may drive the first pixel and the second pixel together, by using the source amplifier of the first pixel, and may deactivate the source amplifier of the second pixel. Additional information regarding the sharing of the source amplifier among adjacent pixels may be provided through FIGS. **2** to **9**.

The display panel **160** may display the output data by the display driving circuit **200**. According to embodiments, the display panel **160** may be implemented as a thin film transistor-liquid crystal display (TFT-LCD) panel, a light emitting diode (LED) display panel, an organic LED (OLED) display panel, an active matrix OLED (AMOLED) display panel, a flexible display panel, or the like.

The display panel **160**, for example, may have a structure in which gate lines and source lines are intersected in a matrix form.

A gate signal may be supplied to the gate lines. According to an embodiment, a first gate signal may be supplied to odd gate lines among the gate lines, and a second gate signal may be supplied to even gate lines. The first gate signal and the second gate signal may include a signal alternately supplied to each other. Alternatively, after the first gate signal is sequentially supplied from a start line to an end line of the odd gate lines, the second gate signal may be sequentially supplied from the start line to the end line of the even gate lines.

A signal corresponding to the output data may be supplied to the source lines. The signal corresponding to the output data may be supplied to a source driver under the control of a timing controller inside the display driving circuit **140**.

FIG. **2** is a diagram illustrating a display driving circuit according to various embodiments.

Referring to FIGS. **1** and **2**, the display driving circuit **200** is an interface circuit **201**, a logic circuit **202**, a graphic memory **203**, a data latch (or shift register) **205**, a source driver **206**, a gate driver **207**, and a gamma generator **208**.

The interface circuit **201** may interface signals or data exchanged between the processor **140** and the display driving circuit **200**. The interface circuit **201** may interface line data transmitted from the processor **140**, and may transmit the interfaced line data to a graphic memory write controller of the logic circuit **202**.

According to one embodiment, the interface circuit **201** may be an interface related to a serial interface, such as a Mobile Industry Processor Interface (MIPI®), a Mobile Display Digital Interface (MDDI), a DisplayPort, an Embedded DisplayPort (eDP), or the like.

According to various embodiments, the logic circuit **202** may include the graphic memory write controller, the timing controller, a graphic memory read controller, an image processing unit, a source shift register controller, a data shift register, and a source sharing control unit.

The graphic memory write controller of the logic circuit **202** may receive the line data transmitted from the interface circuit **201** and may control an operation of writing the received line data in the graphic memory **203**.

The timing controller may supply a synchronizing signal and/or a clock signal to each component (e.g., a data comparison circuit or the graphic memory read controller) of the display driving circuit **200**. In addition, the timing controller may transmit a read command (RCMD) for controlling a read operation of the graphic memory **203** to the graphic memory read controller.

According to various embodiments, the timing controller may control output data supply of the source driver **206**. In addition, the timing controller may control a gate signal output of the gate driver **207**. For example, the timing controller may control the gate driver **207** to output a gate signal by dividing odd and even lines among gate signal lines of the display panel **160**.

According to one embodiment, the timing controller may control the source driver **206** to share and use outputs of some amplifiers among a plurality of amplifiers allocated to pixels in response to a control of the processor **140**.

The graphic memory read controller may perform a read operation on the line data stored in the graphic memory **203**. According to an embodiment, the graphic memory read controller may perform the read operation on all or part of the line data stored in the graphic memory **203** based on the read command RCMD for the line data. The graphic memory read controller may transmit all or part of the line data read from the graphic memory **203** to the image processing unit. The graphic memory write controller and the graphic memory read controller are described separately for convenience of description, but may be implemented as one graphic memory controller.

The image processing unit may improve image quality by processing all or part of the line data transmitted from the graphic memory read controller. The output data with improved image quality may be transferred to the timing controller, and the timing controller may transmit the output data to the source driver **206** through the data latch **205**.

The source shift register controller may control a data shifting operation of the data shift register. According to an embodiment, the source shift register controller may perform a control such as writing the line data of the graphic memory **203** and image preprocessing of the image processing unit in response to instructions provided from the processor **140**.

The data shift register may shift output data transmitted through the source shift register controller under control of the source shift register controller. The data shift register may sequentially transmit the shifted output data to the data latch **205**.

The source sharing control unit may detect a scene transition level of image data received from the processor **140**. The scene transition level may be calculated based at least on a difference value of output data between a previous frame and a current frame (or a difference value of output data between a current frame and a subsequent frame) to be output using at least a part of the display panel. For example, in the case of a video playback screen, the scene transition level may be relatively large. For another example, in the case of a web search screen that does not include a video, the scene transition level may be relatively small.

The source sharing control unit may determine a threshold value required for control of the source amplifier, and may control a switch connected to the source amplifier, based on the determined threshold value. The source sharing control unit may limit outputs of some source amplifiers under a specified condition, thereby reducing power consumed by the display panel **160**. Additional information regarding the sharing of the source amplifier between adjacent pixels may be provided through FIGS. **3**A to **9**.

The graphic memory **203** may store the line data input through the graphic memory write controller under the control of the graphic memory write controller. The graphic memory **203** may operate as a buffer memory in the display driving circuit **200**. According to an embodiment, the graphic memory **203** may include a graphic random access memory (GRAM).

The data latch **205** may store output data sequentially transmitted from a data shift register. The data latch **204** may transmit the stored output data to the source driver **206** in units of horizontal lines of the display panel **160**.

The source driver **206** may transmit the line data received from the data latch **205** to the display panel **160**. According to an embodiment, the source driver **206** may include a source amplifier connected to each sub-pixel (or per channel allocated to each sub-pixel).

The source driver **206** may share and use the output of the source amplifier between adjacent pixels. The source driver **206** may include switches to activate the source amplifiers and to share the output of the source amplifier. The switches included in the source driver **206** may be turned on or off in response to a control signal provided from the logic circuit **202** (e.g., a timing controller). Accordingly, the source driver **206** may reduce power consumption by activating only some of a plurality of amplifiers allocated to adjacent pixels.

The gate driver **207** may drive the gate lines of the display panel **160**. That is, as an operation of the pixels implemented on the display panel **160** is controlled by the source driver **206** and the gate driver **207**, output data (or an image corresponding to the output data) input from the processor **140** may be displayed on the display panel **160**. The gate driver **207** may divide the gate lines of the display panel **160** into the odd lines or the even lines under the control of the logic circuit **202**, and may supply the gate signal to the divided lines.

The gamma generator **208** may generate and supply a gamma value (or a gamma voltage corresponding to the gamma value) related to brightness adjustment of the display panel **160**. The gamma generator **208** may generate an analog gamma value corresponding to at least one of a first color (e.g., Red), a second color (e.g., Green), and a third color (e.g., Blue), and may supply the generated analog gamma value to the source driver **206**. The analog gamma value may be generated based on a gamma curve stored in correspondence with a designated color.

FIG. **3**A is a diagram illustrating an example of some components of an electronic device including a pentile display panel according to various embodiments. FIG. **3**A is exemplary and is not limited thereto.

Referring to FIGS. **2** and **3**A, some components of the electronic device **100** may include the display panel **160** that is a pentile type and the source driver **206**.

The display panel **160** of the pentile type may be, for example, in a form in which the gate lines and pentile source lines are alternately arranged. In FIG. **3**A, although the display panel **160** is illustrated mainly including a case in which a first pixel **161**, a second pixel **162**, a third pixel **163**, and a fourth pixel **164** are disposed adjacent to one another, the disclosure is not limited thereto (refer to FIG. **3**B).

Pads connected to the output terminals of the amplifiers of the source driver **206** may be disposed on one side of the display panel **160**, for example, at one end of each channel of the pentile source lines.

In the first pixel **161**, the source driver **206** may include, for example, a first amplifier **311** supplying a signal to a first channel and a second amplifier **312** supplying a signal to a second channel among the pentile source lines. In addition, the source driver **206** may include a first switch **311***a* that is connected to an output terminal of the first amplifier **311** and a second switch **312***a* that is connected to an output terminal of the second amplifier **312**.

In the second pixel **162**, the source driver **206** may include a third amplifier **313** supplying a signal to a third channel and a fourth amplifier **314** supplying a signal to a fourth channel. In addition, the source driver **206** may include a third switch **313***a* that is connected to an output terminal of the third amplifier **313** and a fourth switch **314***a* that is connected to an output terminal of the fourth amplifier **314**.

In the third pixel **163**, the source driver **206** may include, for example, a first amplifier **321** supplying the signal to the first channel and a second amplifier **322** supplying the signal to the second channel among the pentile source lines. In addition, the source driver **206** may include a first switch **321***a* that is connected to an output terminal of the first amplifier **321** and a second switch **322***a* that is connected to an output terminal of the second amplifier **322**.

In the fourth pixel **164**, the source driver **206** may include a third amplifier **323** supplying the signal to the third channel and a fourth amplifier **324** supplying the signal to the fourth channel. In addition, the source driver **206** may include a third switch **323***a* that is connected to an output terminal of the third amplifier **323** and a fourth switch **324***a* that is connected to an output terminal of the fourth amplifier **324**.

According to various embodiments, the source driver **206** may include first to fourth sharing switches **311***b*, **312***b*, **313***b*, and **314***b*. The first sharing switch **311***b* may be disposed between the output terminal of the first amplifier **311** of the first pixel **161** and the output terminal of the first amplifier **321** of the third pixel **163**. The second sharing switch **312***b* may be disposed between the output terminal of the second amplifier **312** of the first pixel **161** and the output terminal of the second amplifier **322** of the third pixel **163**. The third sharing switch **313***b* may be disposed between the output terminal of the third amplifier **313** of the second pixel **162** and the output terminal of the third amplifier **323** of the fourth pixel **164**. The fourth sharing switch **314***b* may be disposed between the output terminal of the fourth amplifier **314** of the second pixel **162** and the output terminal of the fourth amplifier **324** of the fourth pixel **164**.

According to various embodiments, the display driving circuit **200**, when the output data of adjacent pixels are the same or within a specified threshold value (hereinafter, a shared threshold value), may drive other pixels together using the first to fourth sharing switches **311***b*, **312***b*, **313***b*, and **314***b*, by using source amplifiers corresponding to one pixel. For example, in FIG. **3**A, the display driving circuit **200** may supply the output of the source amplifier supplied to the first pixel **161** and the second pixel **162** to the third pixel **163** and the fourth pixel **164** by using the first to fourth sharing switches **311***b*, **312***b*, **313***b*, and **314***b*.

For example, the display driving circuit **200** may calculate a difference value between output data of the first pixel **161** and output data of the third pixel **163**. When the difference value is within a shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on the first and second source amplifiers **311** and **312** corresponding to the first pixel **161**, and may turn off the first and second source amplifiers **321** and **322** corresponding to the third pixel **163**. When the difference value exceeds the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on both the first and second source amplifiers **311** and **312** corresponding to the first pixel **161** and the first and second source amplifiers **321** and **322** corresponding to the third pixel **163**.

For another example, the display driving circuit **200** may calculate a difference value between output data of the second pixel **162** and output data of the fourth pixel **164**. When the difference value is within the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on the third and fourth source amplifiers **313** and **314** corresponding to the second pixel **162**, and may turn off the third and fourth source amplifiers **323** and **324** corresponding to the fourth pixel **164**. When the difference value exceeds the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on both the third and fourth source amplifiers **313** and **314** corresponding to the second pixel **162** and the third and fourth source amplifiers **323** and **324** corresponding to the fourth pixel **164**.

According to various embodiments, the display driving circuit **200** may adjust the shared threshold value, based on the scene transition level of the displayed image. For example, in the case of video playback having a lot of screen transitions, the shared threshold value may be increased (e.g., 2 to 7 grayscale). For another example, in the case of a web page having relatively few screen transitions, the shared threshold value may be decreased (e.g., 0 to 2 grayscale). Additional information regarding a method of controlling the source amplifier, based on the scene transition level may be provided through FIGS. **4**A to **9**.

According to various embodiments, the display driving circuit **200** may keep the first to fourth source amplifiers **311** to **314** that supply output data to the first pixel **161** and the second pixel **162** always turned on. In contrast, the display driving circuit **200** may turn on or off the first to fourth source amplifiers **321** to **324** that supply output data to the third pixel **163** and the fourth pixel **164**, based on an image pattern (scene transition level). Through this, in a screen where there are many pixels having the same or similar output data value as the surrounding pixels (e.g., an Internet search screen, an SNS screen), the power consumed by the display panel **160** may be reduced by up to 50%.

The above-described control of the amplifier and the above-described control of the switches may be performed by, for example, instructions received from the processor **140** and written to the source shift register controller. An instruction written in the source shift register controller is transferred to a timing controller, and the timing controller may perform a data transfer depending on execution of the instruction.

FIG. **3**B illustrates sharing of a source amplifier among pixels within a specified distance according to various embodiments.

Referring to FIG. **3**B, the display driving circuit **200** may share a source amplifier among the pixels spaced apart by a specified distance.

For example, the display driving circuit **200** may share the output of the source amplifier of the first pixel **161** and the second pixel **162** with N-th pixels (e.g., N=5, 7, . . .) and N+1-th pixels, which are separated by a specified distance, not the adjacent third pixel **163** and the fourth pixel **164**.

The source driver **206** may include first to fourth sharing switches **311***c*, **312***c*, **313***c*, and **314***c*. The first sharing switch **311***c* may be disposed between the output terminal of the first amplifier **311** of the first pixel **161** and an output terminal of a first amplifier **321**N of the N-th pixel. The second sharing switch **312***c* may be disposed between the output terminal of the second amplifier **312** of the first pixel **161** and an output terminal of a second amplifier **322**N of the N-th pixel. The third sharing switch **313***c* may be disposed between the output terminal of the third amplifier **313** of the second pixel **162** and an output terminal of a third amplifier **323**N of the N+1-th pixel. The fourth sharing switch **314***c* may be disposed between the output terminal of the fourth amplifier **314** of the fourth pixel **162** and an output terminal of a fourth amplifier **324**N of the N+1-th pixel.

According to various embodiments, when output data of adjacent pixels are the same or are within a specified threshold value (hereinafter, shared threshold value), the display driving circuit **200** may drive other pixels together, using the first to fourth sharing switches **311***c*, **312***c*, **313***c*, and **314***c*, by using source amplifiers corresponding to one pixel. For example, in FIG. **3**B, the display driving circuit **200** may supply an output of the source amplifier supplied to the first pixel **161** and the second pixel **162** to the third pixel **163** and the fourth pixel **164** by using the first to fourth sharing switches **311***b*, **312***b*, **313***b*, and **314***b*.

For example, the display driving circuit **200** may calculate a difference value between the output data of the first pixel **161** and output data of the N-th pixel. When the difference value is within the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on the first and second source amplifiers **311** and **312** corresponding to the first pixel **161**, and may turn off the first and second source amplifiers **321**N and **322**N corresponding to the N-th pixel. When the difference value exceeds the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on both the first and second source amplifiers **311** and **312** corresponding to the first pixel **161** and the first and second source amplifiers **321**N and **322**N corresponding to the N-th pixel.

For another example, the display driving circuit **200** may calculate a difference value between the output data of the second pixel **162** and output data of the N+1-th pixel. When the difference value is within the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on the third and fourth source amplifiers **313** and **314** corresponding to the second pixel **162**, and may turn off the third and fourth source amplifiers **323**N and **324**N corresponding to the N+1-th pixel. When the difference value exceeds the shared threshold value (e.g., 0 to 2 grayscale), the display driving circuit **200** may turn on both the third and fourth source amplifiers **313** and **314** corresponding to the second pixel **162** and the third and fourth source amplifiers **323**N and **324**N corresponding to the N+1-th pixel.

FIG. **4**A is a flowchart illustrating an image output method according to various embodiments.

Referring to FIG. **4**A, in operation **401**, the display driving circuit **200** may receive image data associated with a plurality of pixels from the processor **140**.

In operation **402**, the display driving circuit **200** may identify the output data of the first pixel and the output data of the second pixel included in a plurality of pixels to which the output of the source amplifier may be shared.

In operation **403**, the display driving circuit **200** may determine whether the output data of the first pixel and the output data of the second pixel have a specified similarity or higher. In one embodiment, the similarity may increase as the difference value between the output data of the first pixel and the output data of the second pixel decreases, and may decrease as the difference value increases.

In operation **404**, when the output data of the first pixel and the output data of the second pixel have the specified similarity or higher, the display driving circuit **200** may drive the first pixel and the second pixel by using the source amplifier specified in relation to the first pixel. For example, when the difference value between the output data of the first pixel and the output data of the second pixel is within the specified shared threshold value (e.g., 2 grayscale), the display driving circuit **200** may drive the first pixel and the second pixel by using the source amplifier specified in relation to the first pixel.

FIG. **4**B is a flowchart illustrating an image output method according to various embodiments.

Referring to FIG. **4**B, in operation **410**, the display driving circuit **200** may receive the image data from the processor **140**.

In operation **420**, the display driving circuit **200** may determine the scene transition level of the image data. For example, the scene transition level may be a degree to which a sum of output data is changed at a specified calculation period (e.g., every 1 frame, every 3 frames, etc.). The display driving circuit **200** may determine the scene transition level by comparing the sum of the output data with one or more preset reference values.

In operation **430**, the display driving circuit **200** may determine the shared threshold value to be applied to the sharing of the source amplifier, based on the determined scene transition level. When the scene transition level is relatively large (e.g., playing a video), the display driving circuit **200** may set the shared threshold value to a relatively high value (e.g., 2 to 7 grayscale). In contrast, when the scene transition level is relatively small (e.g., displaying text or a still image), the display driving circuit **200** may relatively lower the shared threshold value (e.g., 0 to 2 grayscale).

In operation **440**, the display driving circuit **200** may share the output of at least one source amplifier between pixels adjacent to each other, based on the determined shared threshold value. When the output of the source amplifier of the first pixel is shared with the second pixel, the display driving circuit **200** may limit the output of the source amplifier corresponding to the second pixel, thereby reducing the power consumed by the display panel **160**.

According to various embodiments, the display driving circuit **200** may set the source amplifier sharing method differently by dividing the display panel **160** into a plurality of sections. For example, the display driving circuit **200** may divide the screen into four sections by dividing the screen in a horizontal direction, and may determine the scene transition level for each section. The display driving circuit **200** may set the shared threshold value differently for each section depending on the scene transition level determined in each section. For another example, the display driving circuit **200** may divide the screen into four sections by dividing the screen in the horizontal direction, and may determine the scene transition level for some sections. The display driving circuit **200** may set the shared threshold value differently for each section depending on the scene transition level determined in the some sections.

According to various embodiments, the display driving circuit **200** may divide the display panel **160** into a plurality of sectors, and may determine the scene transition level in each sector. The display driving circuit **200** may set a first shared threshold value that is a relatively large value for a moving section in which the scene transition level is greater than or equal (or excess) to a specified reference value. The display driving circuit **200** may set a second shared threshold value that is a relatively small value for a still section in which the scene transition level is less than (or less than or equal) the specified reference value. The display driving circuit **200** may share the source amplifier between adjacent pixels depending on the shared threshold value set in each section.

FIG. **5** illustrates a change of a shared threshold value depending on a scene transition according to various embodiments. FIG. **5** is exemplary and is not limited thereto.

Referring to FIG. **5**, a first screen "A" may be a still image in which there is no a separate scene transitions. A second screen "B" may be a screen in which a video is played in part and a still image is included in another part. A third screen "C" may be a screen in which the video is played as a whole.

The display driving circuit **200** may detect the scene transition level of an image currently being output, and may determine the shared threshold value to be applied to image data to be subsequently output.

For example, in a state in which the first screen "A" is being output to the display panel **160**, the display driving circuit **200** may analyze image data corresponding to the first screen "A". The display driving circuit **200** may compare image data at a specified frame interval. When it is determined as a still image without separate moving, the display driving circuit **200** may set a relatively low level shared threshold value (e.g., 0 to 1 grayscale). When the output data between adjacent pixels is within the shared threshold value (e.g., 0 to 1 grayscale), the source amplifier may be shared. When the output data between adjacent pixels exceeds the shared threshold value, each pixel may be driven by separate source amplifiers.

At a time t**1**, when the image data change from the first screen "A" to the third screen "C", at a time t**2**, the display driving circuit **200** may detect the scene transition.

The display driving circuit **200** in response to the detection of the scene transition, may set a relatively high level of shared threshold value (e.g., 2 to 7 grayscale) to correspond to the third screen "C" that is the video screen as a whole.

In one embodiment, when the scene is transitioned, the display driving circuit **200** may sequentially increase the shared threshold value. For example, after the screen transition is detected, the display driving circuit **200** may maintain the shared threshold value for a first frame **511** as 1 grayscale. The display driving circuit **200** may change the shared threshold value for a second frame **512** that is a subsequent frame to 2 grayscale. The display driving circuit **200** may change the shared threshold value for the third frame **513** that is a subsequent frame to 3 grayscale.

According to an embodiment, while the third screen "C" is maintained, the display driving circuit **200** may dynamically change the shared threshold value in a specified range (e.g., 2 to 7 grayscale) depending on the scene transition level of displayed content.

At a time t**3**, when the image data change from the third screen "C" to the second screen "B", at a time t**4**, the display driving circuit **200** may detect the scene transition.

The display driving circuit **200** may set an intermediate level shared threshold value to correspond to the second screen "B" that is the video screen as a whole in response to detection of the scene transition.

FIG. **6** is an exemplary view of a screen sharing a source amplifier by dividing a display panel into a plurality of sections, according to various embodiments. FIG. **6** is exemplary and is not limited thereto.

Referring to FIG. **6**, the display driving circuit **200** may divide the display panel **160** into a plurality of sections and may set a shared threshold value for each section. The display driving circuit **200** may share the source amplifier between adjacent pixels, based on the shared threshold value set in each section.

According to an embodiment, the display driving circuit **200** may receive a control signal from the processor **140** and may divide the display panel **160** into the plurality of sections, based on the received control signal. The display driving circuit **200** may receive coordinate information for distinguishing sections of the display panel **160** from the processor **140**, independent of the image data for output.

For example, the display driving circuit **200** may receive CASET and PASET (2 Ah and 2 Bh) settings that set the section in which the screen is updated from the processor **140**. Alternatively, the display driving circuit **200** may receive coordinate information for setting the section for each application from the processor **140**.

According to various embodiments, the processor **140** may provide coordinate information associated with an indication bar section **610**, a moving section **620** where a video is played, a still section **630** where a still image is played, and a navigation bar section **640** to the display driving circuit **200** depending on the type of the application being executed. The display driving circuit **200** may divide the display panel **160**, based on the received coordinate information. The display driving circuit **200** may set a fixed shared threshold value for some sections without calculating the scene transition level. For example, the indication bar **610** and the navigation bar **620** may apply sharing of the source amplifier, based on the fixed shared threshold value, respectively.

According to various embodiments, the display driving circuit **200** may receive user interface information associated with an application executed in the moving section **620** and the still section **630**. For example, the display driving circuit **200** may store information regarding a changeable user interface in advance, and may set the shared threshold value of each section, based on the stored information.

According to various embodiments, the display driving circuit **200** may receive information associated with a type (or category) of an application being executed from the processor **140**. The display driving circuit **200** may store information regarding the changeable user interface in the received category in advance, and may set the shared threshold value for each section, based on the stored information. For example, when the application being executed is an e-book app, the display driving circuit **200** may apply the fixed shared threshold value without calculating the scene transition level. For another example, when the application being executed is a game app, the display driving circuit **200** may set the shared threshold value by calculating the scene transition level in an entire section.

According to various embodiments, the display driving circuit **200** may partially change the shared threshold value, based on illuminance information or brightness information. For example, when ambient illuminance detected by the sensor is greater than or equal to a specified value, the display driving circuit **200** may set a shared setting value relatively high. For another example, when brightness set in the electronic device **101** exceeds the specified value, the shared setting value may be set relatively low.

According to various embodiments, the display driving circuit **200** may set the shared threshold value depending on a driving mode (e.g., normal mode/power saving mode/ultra-power saving mode) of the electronic device **101**. For example, when the electronic device **101** is in the ultra-power saving mode, the display driving circuit **200** may set the shared threshold value relatively high.

FIG. **7** is an exemplary view of a screen detecting a moving section according to various embodiments.

Referring to FIG. **7**, the display driving circuit **200** may divide at least a part (hereinafter, an analysis section) of the display section into a plurality of sections, and may set the shared threshold value for each section.

According to an embodiment, the display driving circuit **200** may set the entire section of the display panel **160** as the analysis section. The display driving circuit **200** may divide the entire section of the display panel **160** into a plurality of sections, and may calculate the scene transition level in each section.

For another example, remaining sections except for the indication bar section at the top of the display panel **160** and the navigation bar section at the bottom of the display panel **160** may be set as the analysis section. Hereinafter, the analysis section will be mainly discussed in the case where it is set except for the indicator bar section and the navigation bar section, but is not limited thereto.

On a screen **701**, the display driving circuit **200** may display the image data in which the still image is displayed as the background and a video is being executed in some sections. The display driving circuit **200** may set the remaining sections except for an indicator bar section **710** and a navigation bar **730** as an analysis section **720**. The analysis section **720** may include an actual moving section (e.g., a video playback section) **725** at least partially.

On a screen **702**, the display driving circuit **200** may divide the analysis section **720** into a specified number of sections. For example, the display driving circuit **200** may divide the analysis section **720** into two columns in a vertical direction and may divide them into five rows in the horizontal direction, and may divide them into a total of 10 sections. In FIG. **8**, a case where the display driving circuit **200** divides the analysis section **720** into first to tenth sections is exemplarily illustrated, but is not limited thereto. For example, the display driving circuit **200** may divide the separate section **720** into 2, 4, 6, 8, or the like.

According to various embodiments, the display driving circuit **200** may dynamically divide the analysis section **720**, based on information (e.g., application information being driven, information on displayed content, information on brightness setting of the display, and information about power driving mode) received from the processor **140**

On a screen **703**, the display driving circuit **200** may calculate the scene transition level in each section. The display driving circuit **200** may apply various types of scene transition detection algorithms. For example, the display driving circuit **200** may sum the values of the output data of the current frame for each section and may compare the summed results with a sum of the output data of the previous frame.

The display driving circuit **200** may determine a section in which a difference in output data between a current frame and a previous frame exceeds a reference value as the moving section. The display driving circuit **200** may determine a section in which the difference in output data between the current frame and the previous frame does not exceed a moving reference value as the still section. In the example of FIG. **8**, the third to tenth sections may be moving sections. The first section and the second section may be the still sections. According to an embodiment, the moving section or the still section may be determined by sampling some pixels in each section.

The display driving circuit **200** may combine each moving section and set it as a moving section **726** that is detected.

According to various embodiments, the display driving circuit **200** may set the first shared threshold value with respect to the moving sections (third to tenth sections). The display driving circuit **200** may set the second shared threshold value with respect to the still sections (first section and second section). The first shared threshold value may be greater than the second shared threshold value. In one embodiment, the first shared threshold value may be a value that changes in a specified range. For example, the display driving circuit **200** may set the first shared threshold value to one of 2 to 7 grayscales. When the scene transition level of the moving section is large, the display driving circuit **200** may set the shared threshold value (e.g., 7 gray scale) that has a relatively large value. In contrast, when the scene transition level of the moving section is small, the display driving circuit **200** may set the shared threshold value (e.g., 2 gray scale) that has a relatively small value.

On a screen **704**, the display driving circuit **200**, when a ratio of the moving section **726** to the analysis section **720** is a preset first ratio (e.g., 80%) or more, may set the entire analysis section **720** as the moving section. The display driving circuit **200** may share the source amplifier with respect to the entire analysis section **720**, based on the first shared threshold value applied to the moving section.

According to another embodiment, when the ratio of the moving section **726** to the analysis section **720** is equal to or less than a preset second rate (e.g., 20%), the display driving circuit **200** may allow the source amplifier to be shared with respect to the entire analysis section **720**, based on the second shared threshold value applied to the still section. Alternatively, the display driving circuit **200** may not apply the sharing of the source amplifier with respect to the entire analysis section **720**.

FIG. **8** is an exemplary view of a screen determining a moving section in a dynamic manner according to various embodiments. FIG. **8** is exemplary and is not limited thereto.

Referring to FIG. **8**, on a screen **801**, the display driving circuit **200** may display the image data in which the still image is displayed as the background and a video is being executed in some sections. The display driving circuit **200** may set remaining sections except for an indicator bar section **810** and a navigation bar **830** as an analysis section **820**.

The display driving circuit **200** may divide the analysis section **820** into a specified number of sections. The display driving circuit **200** may calculate the scene transition level in each section. The display driving circuit **200** may determine a section in which the scene transition level exceeds the specified moving reference value as the moving section.

The display driving circuit **200** may combine each of the moving sections to set a detected moving section **826**. The display driving circuit **200** may extract a detected moving section **726** greater than an actual moving section **825** through primary detection.

The sharing threshold value to which the sharing of the source amplifier is applied may be different from each other, focusing on the boundary between the moving section **826** and a still section **824**. For example, back and forth of a boundary between a second section that is part of the still section **824** and a fourth section that is part of the moving section **826**, the sections are all the same actual still section, but the first shared threshold value having a relatively large value may be applied to the fourth section, and the second shared threshold value having a relatively small value may be applied to the second section. Due to this, there is a possibility that the user senses a level difference in image quality at the boundary between the moving section **826** and the still section **824**.

According to various embodiments, the display driving circuit **200** may reset the boundary between the moving section **826** and the still section **824** by an adaptive method to prevent a user from sensing the level difference in the image quality.

For example, the display driving circuit **200** may separate a section (third section and fourth section) contacting the still section **824** of the moving section **826** into the first section contacting the still section **824** and a second section separated from the still section **824**. The display driving circuit **200** may calculate the scene transition level in a first part and a second part, respectively.

When both the first part and the second part are the moving sections, the display driving circuit **200** may repeat division and calculation of scene transition level with respect to the first part. When the first part is the still section and the second part is the moving section, the display driving circuit **200** may repeat division and calculation of scene transition level with respect to the second par. When the first part or the second part becomes less than the minimum division unit (e.g., 10 pixels), the display driving circuit **200** may determine a new boundary between the moving section and the still section, based on the boundary between the first part and the second part.

For example, at the boundary between the second section and the fourth section (or the boundary between the first section and the third section), the display driving circuit **200** may divide the third section and the fourth section into first part **841** and second part **842**. When both the first part **841** and the second part **842** are the moving sections, the display driving circuit **200** may further divide the first part **841** into a first part **841***a* and a second part **842***b*.

When the first part **841***a* is the still section, and the second part **842***b* is the moving section, the second part **842***b* may be divided into a first part **841***b***1** and a second part **841***b***2**.

When a width of the first part **841***b***1** and the second part **841***b***2** is less than a preset minimum pixel width (e.g., 10 pixels), and both the first part **841***b***1** and the second part **841***b***2** are the moving section, the display driving circuit **200** may set a boundary **841***b*_N between the first part **841***b***1** and the second part **841***b***2** as a new boundary between the moving section and the still section. Alternatively, the display driving circuit **200** may set a new boundary or set a boundary between the first part **841***a* and the second part **842***b* of a previous stage as a new boundary between the moving section and the still section.

For another example, the display driving circuit **200**, for example, at a boundary between an eighth section and a tenth section (or a boundary between a seventh section and a ninth section), may divide the seventh section and the eighth section into a first part **881** and a second part **882**. When the first part **881** is the still section and the second part **882** is the moving section, the display driving circuit **200** may further divide the second part **882** into a first part **882***a* and a second part **882***b*.

When the first part **882***a* is the still section and the second part **882***b* is the moving section, the second part **88***b* may be divided into a first part **882***b***1** and a second part **882***b***2**.

When a width of the first part **882***b***1** and a width of the second part **882***b***2** is less than a preset minimum pixel width (e.g., 10 pixels), and both the first part **882***b***1** and the second part **882***b***2** are the moving section, the display driving circuit **200** may set a boundary **882***b* N between the first part **882***b***1** and the second part **882***b***2** as a new boundary between the moving section and the still section. Alternatively, the display driving circuit **200** may set a boundary between the first part **882***a* and the second part **882***b* of a previous stage as a new boundary between the moving section and the still section.

On a screen **802**, a moving section **826***a* reset by the adaptive method may be changed close to the actual moving section **825**.

According to various embodiments, the display driving circuit **200** may set a new boundary between the moving section and the still section in a similar manner in left and right directions. Through this, an error between the actual moving section **825** and the detected moving section **826** may be reduced.

FIG. **9** is a flowchart illustrating a method of sharing a source amplifier depending on various conditions according to various embodiments.

Referring to FIG. **9**, in operation **910**, the display driving circuit **200** may receive image data to be output through the display panel **160** from the processor **140**.

In operation **920**, the display driving circuit **200** may determine whether a period for calculating the scene transition level elapses. For example, when the period is 3 frames, the display driving circuit **200** may calculate the scene transition level every 3 frames. For another example, when the period is 1 frame, the display driving circuit **200** may calculate the scene transition level every frame.

According to one embodiment, the period may be stored in advance, reflecting a period in which content is scrolled on a screen, a period of change of a video, a resolution of the display panel **160**, an operation state of an application, and the like.

According to various embodiments, the display driving circuit **200** may change the period, based on information (e.g., application information being driven, information about displayed content, information regarding brightness setting of the display, and information about power driving mode) received from the processor **140**

For example, the display driving circuit **200** may set a relatively long period when the running application is the e-book app and may set a relatively short period when the running application is the game app. For another example, the display driving circuit **200** may set a relatively long period when the display is set to a low brightness, and may set a relatively short period when the display is set to a high brightness.

In operation **930**, the display driving circuit **200** may calculate the scene transition level when the period elapses. According to an embodiment, the display panel may be divided into a plurality of sections, and the scene transition level may be calculated in each section. For example, the scene transition level may be a difference value of a sum of image data of a corresponding section in a previous frame and a sum of image data of a corresponding section in a current frame.

In operation **940**, the display driving circuit **200** may determine whether the moving section is detected. According to an embodiment, the display driving circuit **200** may combine a plurality of moving sections to determine the moving section.

In operation **950**, when the moving section is detected, the display driving circuit **200** may determine whether a minimum moving duration time elapses. For example, the minimum moving duration time may be 3 frames.

In operation **960**, when the minimum moving duration time elapses, the display driving circuit **200** may share the source amplifier between adjacent pixels with the first shared threshold value thus set in advance with respect to the moving section.

According to various embodiments, the display driving circuit **200** may assign a weight to the first shared threshold value, based on the scene transition level.

In operation **970**, when the moving section does not exist or the moving section disappears before the moving minimum duration elapses, the display driving circuit **200** may share the source amplifier between adjacent pixels, based on the second shared threshold value thus set in advance in the still section.

According to various embodiments, when the moving section detected in the analysis section is equal to or greater than a specified ratio, the display driving circuit **200** may apply the first shared threshold value to the entire analysis section.

According to various embodiments, an image output method performed by a display driving circuit of an electronic device includes receiving image data to be displayed through a display panel from a processor of the electronic device, identifying output data of a first pixel and output data of a second pixel to display the image data, and when the output data of the first pixel and the output data of the second pixel have more than a specified similarity, driving the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

According to various embodiments, the driving of the first pixel and the second pixel may include turning on source amplifiers of the first pixel, and deactivating source amplifiers of the second pixel adjacent to the first pixel, based on the similarity, and connecting outputs of source amplifiers of the first pixel to the second pixel.

According to various embodiments, the operation of driving the first pixel and the second pixel may include determining a threshold value, based on a scene transition level of the image data, determining whether the output data of the first pixel and the output data of the second pixel are within the threshold value, when the output value of the first pixel and the output value of the second pixel are within the threshold value, deactivating the source amplifiers of the second pixel, and connecting outputs of the source amplifiers of the first pixel to the second pixel. The determining of the threshold value may include dividing the display panel into a plurality of sections, and calculating the scene transition level for each of the plurality of sections.

According to various embodiments, the dividing into the plurality of sections may include dividing a remaining section of the display panel except for an indication bar section and a navigation bar section into the plurality of sections.

According to various embodiments, the calculating of the scene transition level may include applying a first threshold value to a moving section in which the scene transition level is greater than or equal to a preset reference value among the plurality of sections, and applying a second threshold value less than the first threshold value to a still section in which the scene transition level is less than a preset reference value.

According to various embodiments, the sharing of the output of the source amplifier may include applying the first threshold value to a section greater than a sum of the moving sections when a ratio of the moving section among the plurality of sections is equal to or greater than a preset reference value.

FIG. **10** is a block diagram of an electronic device **2001** in a network environment **2000** according to various embodiments.

Referring to FIG. **10**, the electronic device **2001** (e.g., the electronic device **101** of FIG. **1**) may communicate with an electronic device **2002** through a first network **2098** (e.g., a short-range wireless communication) or may communicate with an electronic device **2004** or a server **2008** through a second network **2099** (e.g., a long-distance wireless communication) in the network environment **2000**. According to an embodiment, the electronic device **2001** may communicate with the electronic device **2004** through the server **2008**. According to an embodiment, the electronic device **2001** may include a processor **2020**, a memory **2030**, an input device **2050**, a sound output device **2055**, a display device **2060**, an audio module **2070**, a sensor module **2076**, an interface **2077**, a haptic module **2079**, a camera module **2080**, a power management module **2088**, a battery **2089**, a communication module **2090**, a subscriber identification module **2096**, and an antenna module **2097**. According to some embodiments, at least one (e.g., the display device **2060** or the camera module **2080**) among components of the electronic device **2001** may be omitted or other components may be added to the electronic device **2001**. According to some embodiments, some components may be integrated and implemented as in the case of the sensor module **2076** (e.g., a fingerprint sensor, an iris sensor, or an illuminance sensor) embedded in the display device **2060** (e.g., a display).

The processor **2020** may operate, for example, software (e.g., a program **2040**) to control at least one of other components (e.g., a hardware or software component) of the electronic device **2001** connected to the processor **2020** and may process and compute a variety of data. The processor **2020** may load a command set or data, which is received from other components (e.g., the sensor module **2076** or the communication module **2090**), into a volatile memory **2032**, may process the loaded command or data, and may store result data into a nonvolatile memory **2034**. According to an embodiment, the processor **2020** may include a main processor **2021** (e.g., a central processing unit or an application processor) and an auxiliary processor **2023** (e.g., a graphic processing device, an image signal processor, a sensor hub processor, or a communication processor), which operates independently from the main processor **2021**, additionally or alternatively uses less power than the main processor **2021**, or is specified to a designated function. In this case, the auxiliary processor **2023** may operate separately from the main processor **2021** or embedded.

In this case, the auxiliary processor **2023** may control, for example, at least some of functions or states associated with at least one component (e.g., the display device **2060**, the sensor module **2076**, or the communication module **2090**) among the components of the electronic device **2001** instead of the main processor **2021** while the main processor **2021** is in an inactive (e.g., sleep) state or together with the main processor **2021** while the main processor **2021** is in an active (e.g., an application execution) state. According to an embodiment, the auxiliary processor **2023** (e.g., the image signal processor or the communication processor) may be implemented as a part of another component (e.g., the camera module **2080** or the communication module **2090**) that is functionally related to the auxiliary processor **2023**. The memory **2030** may store a variety of data used by at least one component (e.g., the processor **2020** or the sensor module **2076**) of the electronic device **2001**, for example, software (e.g., the program **2040**) and input data or output data with respect to commands associated with the software. The memory **2030** may include the volatile memory **2032** or the nonvolatile memory **2034**.

The program **2040** may be stored in the memory **2030** as software and may include, for example, an operating system **2042**, a middleware **2044**, or an application **2046**.

The input device **2050** may be a device for receiving a command or data, which is used for a component (e.g., the processor **2020**) of the electronic device **2001**, from an outside (e.g., a user) of the electronic device **2001** and may include, for example, a microphone, a mouse, or a keyboard.

The sound output device **2055** may be a device for outputting a sound signal to the outside of the electronic device **2001** and may include, for example, a speaker used for general purposes, such as multimedia play or recordings play, and a receiver used only for receiving calls. According to an embodiment, the receiver and the speaker may be either integrally or separately implemented.

The display device **2060** (e.g., the display **110** of FIG. **1**) may be a device for visually presenting information to the user and may include, for example, a display, a hologram device, or a projector and a control circuit for controlling a corresponding device. According to an embodiment, the display device **2060** may include a touch circuitry or a pressure sensor for measuring an intensity of pressure on the touch.

The audio module **2070** may convert a sound and an electrical signal in dual directions. According to an embodiment, the audio module **2070** may obtain the sound through the input device **2050** or may output the sound through an external electronic device (e.g., the electronic device **2002** (e.g., a speaker or a headphone)) wired or wirelessly connected to the sound output device **2055** or the electronic device **2001**.

The sensor module **2076** may generate an electrical signal or a data value corresponding to an operating state (e.g., power or temperature) inside or an environmental state outside the electronic device **2001**. The sensor module **2076** may include, for example, a gesture sensor, a gyro sensor, a barometric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a proximity sensor, a color sensor, an infrared sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

The interface **2077** may support a designated protocol wired or wirelessly connected to the external electronic device (e.g., the electronic device **2002**). According to an embodiment, the interface **2077** may include, for example, an HDMI (high-definition multimedia interface), a USB (universal serial bus) interface, an SD card interface, or an audio interface.

A connecting terminal **2078** may include a connector that physically connects the electronic device **2001** to the external electronic device (e.g., the electronic device **2002**), for example, an HDMI connector, a USB connector, an SD card connector, or an audio connector (e.g., a headphone connector).

The haptic module **2079** may convert an electrical signal to a mechanical stimulation (e.g., vibration or movement) or an electrical stimulation perceived by the user through tactile or kinesthetic sensations. The haptic module **2079** may include, for example, a motor, a piezoelectric element, or an electric stimulator.

The camera module **2080** may shoot a still image or a video image. According to an embodiment, the camera module **2080** may include, for example, at least one lens, an image sensor, an image signal processor, or a flash.

The power management module **2088** may be a module for managing power supplied to the electronic device **2001** and may serve as at least a part of a power management integrated circuit (PMIC).

The battery **2089** may be a device for supplying power to at least one component of the electronic device **2001** and may include, for example, a non-rechargeable (primary) battery, a rechargeable (secondary) battery, or a fuel cell.

The communication module **2090** may establish a wired or wireless communication channel between the electronic device **2001** and the external electronic device (e.g., the electronic device **2002**, the electronic device **2004**, or the server **2008**) and support communication execution through the established communication channel. The communication module **2090** may include at least one communication processor operating independently from the processor **2020** (e.g., the application processor) and supporting the wired communication or the wireless communication. According to an embodiment, the communication module **2090** may include a wireless communication module **2092** (e.g., a cellular communication module, a short-range wireless communication module, or a GNSS (global navigation satellite system) communication module) or a wired communication module **2094** (e.g., an LAN (local area network) communication module or a power line communication module) and may communicate with the external electronic device using a corresponding communication module among them through the first network **2098** (e.g., the short-range communication network such as a Bluetooth, a Wi-Fi direct, or an IrDA (infrared data association)) or the second network **2099** (e.g., the long-distance wireless communication network such as a cellular network, an internet, or a computer network (e.g., LAN or WAN)). The above-mentioned various communication modules **2090** may be implemented into one chip or into separate chips, respectively.

According to an embodiment, the wireless communication module **2092** may identify and authenticate the electronic device **2001** using user information stored in the subscriber identification module **2096** in the communication network.

The antenna module **2097** may include one or more antennas to transmit or receive the signal or power to or from an external source. According to an embodiment, the communication module **2090** (e.g., the wireless communication module **2092**) may transmit or receive the signal to or from the external electronic device through the antenna suitable for the communication method.

Some components among the components may be connected to each other through a communication method (e.g., a bus, a GPIO (general purpose input/output), an SPI (serial peripheral interface), or an MIPI (mobile industry processor interface)) used between peripheral devices to exchange signals (e.g., a command or data) with each other.

According to an embodiment, the command or data may be transmitted or received between the electronic device **2001** and the external electronic device **2004** through the server **2008** connected to the second network **2099**. Each of the electronic devices **2002** and **2004** may be the same or different types as or from the electronic device **2001**. According to an embodiment, all or some of the operations performed by the electronic device **2001** may be performed by another electronic device or a plurality of external electronic devices. When the electronic device **2001** performs some functions or services automatically or by request, the electronic device **2001** may request the external electronic device to perform at least some of the functions related to the functions or services, in addition to or instead of performing the functions or services by itself. The external electronic device receiving the request may carry out the requested function or the additional function and transmit the result to the electronic device **2001**. The electronic device **2001** may provide the requested functions or services based on the received result as is or after additionally processing the received result. To this end, for example, a cloud computing, distributed computing, or client-server computing technology may be used.

According to various embodiments, an electronic device includes a processor, a display panel that includes a plurality of pixels, the plurality of pixels including a first pixel and a second pixel, and a display driving circuit that drives the display panel and receives image data to be displayed through the display panel from the processor, and wherein the display driving circuit is composed to identify output data of the first pixel and output data of the second pixel to display the image data, and wherein, when the output data of the first pixel and the output data of the second pixel have more than a specified similarity, the display driving circuit is composed to drive the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

According to various embodiments, the first pixel and the second pixel may be adjacent to each other, and wherein, when the output data of the first pixel and the output data of the second pixel have more than the specified similarity, the display driving circuit may turn on source amplifiers of the first pixel, may deactivate source amplifiers of the second pixel, and may connect outputs of the source amplifiers of the first pixel to the second pixel.

According to various embodiments, at least some of sub-pixels of the first pixel and at least some of sub-pixels of the second pixel, which shares the source amplifier may output light of substantially the same color.

According to various embodiments, the display driving circuit may determine a threshold value, based on a scene transition level of the image data, when the output data of the first pixel and the output data of the second pixel are within the threshold value, may deactivate source amplifiers of the second pixel and may connect outputs of the source amplifiers of the first pixel to the second pixel.

According to various embodiments, the display driving circuit may divide the display panel into a plurality of sections, and may calculate the scene transition level for each of the plurality of sections. The display driving circuit may divide a remaining section except for an indication bar section and a navigation bar section of the display panel into the plurality of sections. The display driving circuit may apply a first threshold value to a moving section of which the scene transition level is greater than or equal to a preset reference value among the plurality of sections, and may apply a second threshold value to a still section of which the scene transition level is less than the preset reference value, and the first threshold value may be greater than the second threshold value.

According to various embodiments, when a ratio of the moving section among the plurality of sections is equal to or greater than a preset reference value, the display driving circuit may apply the first threshold value to a section larger than a sum of the moving sections.

According to various embodiments, the display driving circuit may determine a section in which the scene transition level is maintained over a specified frame or more as the reference value or more among the plurality of sections as the moving section.

According to various embodiments, the display driving circuit may determine a sum section of the moving sections as the moving section, may divide sections disposed at a boundary of the moving section into a first section and a second section, and may calculate the scene transition level in each of the first section and the second section. The display driving circuit may reset the boundary, based on the scene transition level in the first section and the second section.

According to various embodiments, the display driving circuit may receive information associated with a section division of the display panel from the processor, may divide the display panel into a plurality of sections based on the information, and may connect the outputs of the source amplifiers of the first pixel to the second pixel, based on the scene transition level with regard to at least some of the plurality of sections. The display driving circuit may set a fixed threshold value for at least some of the plurality of sections regardless of the scene transition level.

According to various embodiments, each component (e.g., a module or a program) of the components may be composed of a single entity or multiple entities. Some of the aforementioned sub-components may be omitted, or other sub-components may be further included in various embodiments. Alternatively or additionally, some components (e.g., modules or programs) may be integrated into one entity to perform the same or similar functions performed by each corresponding component prior to integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or at least some operations may be executed in a different order or omitted, or other operations may be added.

The invention claimed is:

1. An electronic device comprising:

a processor;

a display panel configured to include a plurality of pixels including a first pixel and a second pixel; and

a display driving circuit configured to drive the display panel and to receive image data to be displayed through the display panel from the processor, and

wherein the display driving circuit is configured to:

divide the display panel into a plurality of sections, and calculate a scene transition level for each of the plurality of sections, determine a moving section among the plurality of sections, wherein the moving section has a plurality of frames with the scene transition level greater than or equal to a preset reference value,

identify output data of the first pixel and output data of the second pixel to display the image data in the moving section, and

when the output data of the first pixel and the output data of the second pixel have more than a specified similarity, drive the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

2. The electronic device of claim **1**, wherein the first pixel and the second pixel are adjacent to each other, and

wherein, when the output data of the first pixel and the output data of the second pixel have more than the specified similarity, the display driving circuit turns on source amplifiers of the first pixel, deactivates source amplifiers of the second pixel, and connects outputs of the source amplifiers of the first pixel to the second pixel.

3. The electronic device of claim **2**, wherein at least some of sub-pixels of the first pixel and at least some of sub-pixels of the second pixel, which share the source amplifier output light of substantially a same color.

4. The electronic device of claim **1**, wherein the display driving circuit determines a threshold value, based on the scene transition level of the image data, when the output data of the first pixel and the output data of the second pixel are within the threshold value, deactivates source amplifiers of the second pixel and connects outputs of the source amplifiers of the first pixel to the second pixel.

5. The electronic device of claim **1**, wherein the display driving circuit divides a remaining section except for an indication bar section and a navigation bar section of the display panel into the plurality of sections.

6. The electronic device of claim **1**, wherein the display driving circuit applies a first threshold value to the moving section, and applies a second threshold value to a still section of which the scene transition level is less than the preset reference value, and

wherein the first threshold value is greater than the second threshold value.

7. The electronic device of claim **6**, wherein, when a ratio of the moving section among the plurality of sections is equal to or greater than a preset reference value, the display driving circuit applies the first threshold value to a section larger than a sum of a number of moving sections.

8. The electronic device of claim **6**, wherein the display driving circuit determines a sum section of a number of moving sections as the moving section, divides sections disposed at a boundary of the moving section into a first section and a second section, and calculates the scene transition level in each of the first section and the second section.

9. The electronic device of claim **8**, wherein the display driving circuit resets the boundary, based on the scene transition level in the first section and the second section.

10. The electronic device of claim **4**, wherein the display driving circuit receives information associated with a section division of the display panel from the processor, divides the display panel into a plurality of sections based on the information, and connects the outputs of the source amplifiers of the first pixel to the second pixel, based on the scene transition level with regard to at least some of the plurality of sections.

11. The electronic device of claim **10**, wherein the display driving circuit sets a fixed threshold value for at least some of the plurality of sections regardless of the scene transition level.

12. An image output method performed by a display driving circuit of an electronic device, the method comprising:

dividing a display panel into a plurality of sections, and calculating a scene transition level for each of the plurality of sections;

determining a moving section among the plurality of sections, wherein the moving section has a plurality of frames with the scene transition level greater than or equal to a preset reference value;

receiving image data to be displayed through a display panel from a processor of the electronic device;

identifying output data of a first pixel and output data of a second pixel to display the image data in the moving section; and

when the output data of the first pixel and the output data of the second pixel have more than a specified similarity, driving the first pixel and the second pixel by using a source amplifier specified in relation to the first pixel.

13. The image output method of claim **12**, wherein the driving of the first pixel and the second pixel includes:

turning on source amplifiers of the first pixel; and

deactivating source amplifiers of the second pixel adjacent to the first pixel, based on the specified similarity, and connecting outputs of source amplifiers of the first pixel to the second pixel.

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